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A compilation of the summary portions of the Research and Technology Objectives and Plans *(RTOPS)* used for management and control of research currently in progress throughout NASA has been published under the title *Research Technology Objectives and Plans Summary, Fiscal Year 1981*. It is announced as accession number **N81-19959**, NASA-TM-82189, on page **1422** of this issue of *STAR*.

RTOP SUMMARY, FY1981 also should help expedite the NASA program of technology transfer to the private sector.

RTOP SUMMARY FY1981 may be purchased from the National Technical Information Service, Springfield, Virginia, 22161, for $14.00 in paper copy or $3.50 in microfiche. (The cost for customers outside the United States is $28.00). The accession number **N81-19959** (NASA-TM-82189) should be specified when ordering this publication.

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1305

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1305

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

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19 SPACECRAFT INSTRUMENTATION **N.A.**

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20 SPACECRAFT PROPULSION AND POWER **1320**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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24 COMPOSITE MATERIALS **1321**

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For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **1327**

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Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **1334**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **1338**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **1340**

Includes land and global communications; communications theory; and optical communications.

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Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

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Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 1419
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1421
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1422
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1422
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1423
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1424
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1425
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1426
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1426
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1427
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1428

Note: N.A. means that no abstracts were assigned to this category for this issue.

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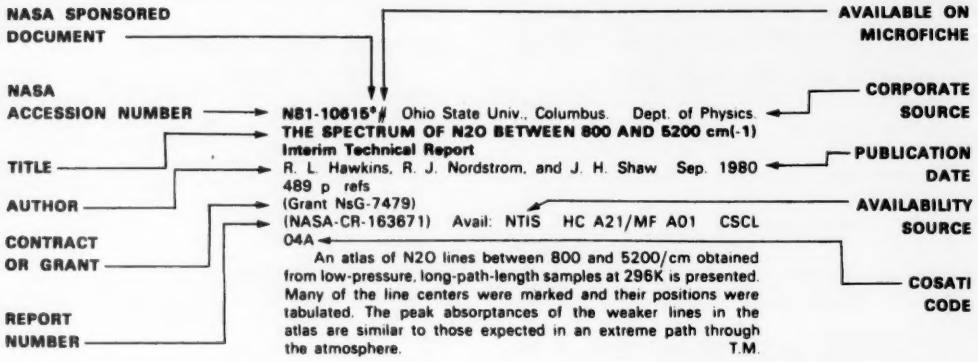
TYPICAL CITATION AND ABSTRACT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N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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AUTHOR
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, VISCOELASTIC BEHAVIOR OF THE INTERVERTEBRAL DISC RELATED TO EJECTION SHOCK

W.G. Knauss, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DF046780; AFOSR-77-3139)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including flail and impact. The body in general and the musculoskeletal system particularly is adversely affected by these forces. This is of special importance in cases of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - non-invasive techniques that may provide information about the mechanical performance of the human intervertebral disc do not exist. This information is important for the diagnosis as well as for the prevention of low back injuries, as may occur in aircraft ejections. This research seeks to set up the basis for the development of such a technique. Objective - the overall objective of this research is to improve the knowledge of the physiology and mechanical properties of the human intervertebral disc. how research contributes - this work should provide essential information to understand the short duration, transient loading problems of the spinal discs and contributes directly to subarea 1.8, 'Aircrew Safety and Effectiveness in Mechanical Force Environments' and will also be applicable to the fields of diagnostic, preventive and reparative medicine.

This final phase of the study will investigate the relaxation behavior of compressed spinal discs as a function of flux of water content under strain spinal section segments will be subject to stress relaxation for various time durations and subsequent measurement of change of water content. Testing will then proceed based upon the influence of fiber orientation on relaxation behavior. In addition to observations of mechanical characterization, it is planned to examine whether visco-elastic lamination theory for fiber-composite solids applies to the composite disc material of the annulus fibrosis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0002, SPECTRUM FATIGUE TESTING OF GRAPHITE/EPOXY BOLTED JOINTS

J.F. Haskins, General Dynamics Corp., Convair Division, *P.O. Box 1950, San Diego, California* 92112 (DN881109; N62269-77-C-0340)

To determine the sensitivity of a graphite/epoxy bolted step joint to environmental exposure when subjected to accelerated flight-by-flight spectrum fatigue loading typical of Navy aircraft. This work is in support of work unit ZA601, 'Aircraft Technology', agency accession no. DN 681080.

A four-step bolted joint between a graphite/epoxy laminate and a 7000 series aluminum alloy. Three series of tests will be performed to determine the statistical distributions of ultimate compression strength, constant amplitude fatigue life in compression; and the compression spectrum fatigue characteristics. Tests will be performed for two environmental conditions; viz. laboratory environment (75degrees F and approximately 50 percent relative humidity and after preconditioning for 120 days at 200 degrees F and 95 percent relative humidity).

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0003, COMBAT MAINTENANCE CONCEPTS AND REPAIR TECHNIQUES (STRUCTURES)

T.N. Cook, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0G0421; DAAK51-79-C-0049)

To develop inspection and field repair concepts for combat damage to Army helicopters structures.

Using the UH-60A Black Hawk, this program will explore the problems associated with the repair of combat-damaged helicopters in the field. Four of the known threats facing helicopters on the modern battlefield will be evaluated. Representative airframe damage will be simulated, structurally analyzed and classified with respect to repairability and deferrability. Generalized criteria for deferrnig combat damage will be developed, and candidate inspection procedures will be defined. Concepts for interim repair of nondeferrable damage will be developed, evaluated and ranked. Based on the results of this work a total combat maintenance support concept for Army helicopter airframes will be re-commended.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, METHODS/DEVICES TO IMPROVE HELICOPTER AUTOROTATION CHARACTERISTICS

A.H. Logan, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0G2747; DAAK51-80-C-0011)

To conduct a prliminary design study of active and passive methods and devices to improve conventional power-off and one-engine-inoperative autorotation capabilities; and to formulate autorotation performance design criteria.

Assemble a compendium of candidate rotorcraft autorotation assist concepts; conduct a qualitative evaluation of selected concepts for a broad matrix of helicopter configuration variables; conduct preliminary design studies of concepts for single-engine, utility, attack and scout-type helicopters and a new generation twin-engine helicopter; conduct a detailed design and analytical evaluation of an auxiliary energy concept for a scout-type helicopter; develop autorotation design criteria to take advantage of autorotation assist concepts.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0005, INVESTIGATION OF FACTORS CAUSING FUEL LEAKS AT STRUCTURAL FASTENERS

J.W. Mahoney, Rockwell International Corp., *International Airport, Los Angeles, California* (DF143870; F33615-79-C-3216)

This work unit supports the requirement for enhanced fuel tightness in integral fuel tanks for USAF aircraft. MIL-A-8867B is directly supported in the area of fuel tank leak testing and MIL-T-5578 in the area of fuel tank sealing. This effort is directed toward solving the problems of fuel leakage at structural fasteners. The objective of this program is to investigate factors

which cause fuel leaks at structural fasteners. The reduction of fuel leak problems will significantly reduce the maintenance costs of USAF aircraft.

This effort will select various structural fastener systems and evaluate their fuel sealing capability. Representative integral fuel tank structure will be fabricated using the selected fastener systems. The structure will be tested under pressure while being subjected to flight-by-flight loading. Recommendations will be made to use the most qualified fasteners in future designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, MICRO O.T.H. TEST
A. Sound, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN082583)

Test the operation of a small target aircraft launching system and flight control system.

Several tests will be conducted consisting of launching the target, flying it for a short period, then recovering it.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0007, INVESTIGATION ON THE CHARACTERISTICS OF TURBULENCE ON A STEP CHANGE OF TRANSVERSE SURFACE STRAIN IN THE SWIRLING BOUNDARY LAYER
H. Higuchi, University of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NCC 2-98)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0008, COMBAT MAINTENANCE CONCEPTS & REPAIR TECHNIQUES (STRUCTURES)
C.P. Hardersen, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0G0222; DAAK51-79-C-0048)

To develop inspection and field repair concepts for combat DMG to Army helicopter structures.

The combat maintenance comcepts and repair techniques program for the AH=1S will be conducted as three consecutive phases. Phase I will identify combat damage, perform structural analyses of damaged conditions and, as a result, produce a set of combat damage inspection techniques/procedures which will successfully classify damage conditions. Phase II will evolve potential repair concepts for the various damage conditions and, after analysis, rank/order these concepts to define the most promising repairs. Phase III will recommend follow-on analyses and tests required to demonstrate the feasibility and practicability of the previously selected repairs, and the resulting costs and scheduling information.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0009, WIND TUNNEL EVALUATION OF AN AEROELASTICALLY CONFORMABLE ROTOR
R.H. Blackwell, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3778; DAAJ02-77-C-0047)

Investigate the ability to improve rotor operational qualities (i.e., performance, efficiency, loads, stability and handling qualities) by deliberately designing aeroelastic properties to exploit the inherent tendency for blades to deform elastically. Determine if significant practical improvement can be made in rotor operational qualities reliability and maintainability, and cost. This effort will be directed toward generation of advanced data pertinent to advanced Army aircraft, including UTTAS, AAH, and ASH.

Conduct thorough review of effects of aeroelastic properties on rotor operational qualities. Select specific significant parameters and objectives which can be evaluated with existing technological capability. Perform rigorous phenomenological studies of the results of parameter variations using advanced analytical tools. Design and fabricate wind tunnel models, and perform comprehensive tests to substantiate analytical findings. Carefully review results to determine specific parametric trends for improving rotor design. Where practical, interpret trends in terms of full scale design characteristics which may be applied in aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, ADVANCED TRANSMISSION COMPONENTS INVESTIGATION - ARMY HELICOPTERS
L.N. Hager, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0D4095; DAAJ02-76-C-0044)

Acquire the technology to attain the following goals over current transmission designs - 20 percent decrease in weight - operate at 100 percent torque limit VS 75 percent for 30 minutes after loss of lube -significant improvements in R&M, vulnerability, and producibility. The results of this program will provide validated technology and integration techniques for use by designers of future transmissions, for reducing transmission development program cost, schedule, and risk.

Design, development test, and system integration test of the following advanced transmission components - welded stainless-steel housing, high contact ratio spur gears of high hot-hardness steel in a final-stage planetary system, and input pinion roller bearing with thrust T carrying capability based on the UH-60A transmission on a back-to-back gearbox rig.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0011, A CORE PROGRAM IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES AT THE NASA LANGLEY RESEARCH CENTER
H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, HIGH SPEED CYLINDRICAL ROLLER BEARING DEVELOPMENT
L. Dobek, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF461730; F33615-77-C-3114)

Extend the state-of-the-art of turbine engine cylindrical roller bearing technology to 3 million DN capability.

Roller bearings will be designed using bearing parameters that have been identified as most important in an existing Navy/Air Force cooperative program with United Technologies, Pratt-Whitney Aircraft Div. Bearings will be fabricated and tested up to 3 million DN. Parameters will be modified and analytical programs will be changed as required to assure a 3 million DN design capability for turbine engine mainshaft roller bearings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0013, THREE DIMENSIONAL TRANSONIC DATA ACQUISITION AND EVALUATION
B.L. Hinson, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF052310; F49620-78-C-0068)

AF function - advanced aerospace vehicles. Deficiency - a lack of reliable experimental data for isolated wings in transonic flow that is suitable for use in developing and evaluating computational methodologies. Objective - to obtain a set of high quality experimental data for isolated wings suitable for evaluating new and future theoretical subsonic and transonic aerodynamic methods, to determine the influence of simple fuselage simulations on the wing aerodynamics, and to evaluate the level of accuracy and computational efficiency of representative versions of the new three dimensional transonic computer codes. How work contributes - the acquisition of a reliable set of transonic wing data will provide a means for comparison of the var-

ious new and developing three dimensional transonic codes which can differ in problem formulation, grid arrangement, finite difference schemes, and solution algorithms. With the availability of a good data base, methods can be assessed. Ultimately, the active use of these computer codes in aircraft design will depend to a large degree on the confidence developed through comparisons with good quality data.

Two supercritical wings, one of high and one of low aspect ratio, designed to produce well-behaved flows will be tested in a high Reynolds number wind tunnel incorporating tunnel wall, boundary layer removal allowing simulation of true isolated wing conditions. The half span wings will be tested with and without a fuselage representation for a range of Mach numbers and angles of attack at which no extensive shock or pressure gradient induced boundary layer separation occurs. Both surface pressure (approximately 160 pressure orifices in each wing) and force balance readings will be taken. Also, a set of computational results will be generated and comparisons made for these test wings using the Bailey-Ballhaus Small Disturbance Code, the Jameson Full Potential Equation Code, and the Jameson Finite Volume Code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0014, STRUCTURE OF VORTEX CORES AND INTERFERENCE EFFECTS DUE TO NEARBY STRUCTURES

C. Brown, Hydronautics Inc., *7210 Pindell School Rd., Laurel, Maryland* 20810 (DF032330; F44620-71-C-0080)

In many AF functions (logistic support, air drop of men and material, quick reaction of a large number of aircraft, etc.) it is necessary for the AF to operate aircraft in highly congested airspace and terminal areas. The ability to accomplish this safely and effectively requires a detailed understanding of the aircraft's flow field and how it interacts with other aircraft and aircraft components. One aspect of this is the large scale roll-up of aircraft trailing vortices and the way this continual stretching of the vortex sheets may inhibit the spread of turbulence and to stabilize the spiral system of layers which only slowly coalesce to produce zones of fluid mixed at the molecular level. This work will attempt, by both theoretical and experimental means, to determine the structure of these vortical flows and the relationship between spiral roll-up and turbulent mixing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0015, EJECTION SEAT TWO AXIS FLUIDIC THRUST VECTORING SYSTEM

R.B. Beale, Honeywell Inc., *2600 Ridgeway Pkwy. N.E., Minneapolis, Minnesota* 55413 (DF136860; F33615-76-C-3070)

Aerodynamic and/or rocket thrust line - center of gravity misalignment can result in ejection seat instability leading to reduced trajectory height, unacceptable loads on the crewmember, and possible recovery parachute entanglement. The objective of this effort is to experimentally validate a selected fluidic thrust vectoring system concept which will be identified by a current AFFDL effort. A system which increases the stability of the ejection seat during the critical rocket burn portion of the trajectory will result in lower major injury and fatality rates for USAF ejection seat escape systems.

The preliminary design of a two-axis fluidic thrust vectoring system which will result from a current AFFDL effort will be utilized as the starting point of this effort. Experimental validation of the fluidic/mechanical components as well as the complete subsystem will be performed utilizing conventional cold gas techniques. An analytical performance evaluation of a fluidically stabilized ejection seat will be conducted concurrently with the experimental validation effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, COMPRESSION FATIGUE LIFE PREDICTION METHODOLOGY AND DATA BASE FOR COMPOSITE STRUCTURES

M. Dill, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN081447; N62269-79-C-0214)

To provide a methodology by which emerging composite aircraft structures can be designed, certified, and managed during the service life of the aircraft with a high degree of confidence that catastrophic failure due to fatigue will not occur. This work is in support of work unit ZA 601, 'Aircraft Technology,' agency accession no. DN 681080.

A coordinated analytical and experimental program will be performed. An analytical compression fatigue life predition methodology that accounts for the effects of temperature and humidity on fatigue behavior will be developed. An experimental program using representative bolted joint test specimens will be performed to valiate the developed methodology. Comparisons of predicted and measured life will be used to provide guidelines for improved durability design practices, certification procedures and fleet maintenance and management decisions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0017, ILS RANGE RATE DETECTION AND DISPLAY

C. McWilliams, Wilcox Electric Co. Inc., *Kansas City, Missouri* (DF144420; F33615-79-C-3625)

The objective of this effort is to provide and maintain experimental equipment that was used under the Wind Shear Support Program (24030258) to test and evaluate experimental wind shear aiding concept. The problem area is to provide ground speed information to the flight crew without the use of expensive and sophisticated navigation systems. The technical objective is to provide a modified ILS-localizer system that will provide accurate ground speed information with a reliable update rate so that the information would be useful as a wing shear penetration aid. The military payoff would be an inexpensive method of providing a wind shear aiding capability to increase operations safety and the probability of successful mission completion.

Contractual effort will be used to modify, install, and maintain a test ILS-localizer transmitter. This unit will transmit an additional signal to provide a reference for measuring the Doppler shift as the aircraft travel along the localizer course. The ground speed is proportional to the Doppler shift. The contractor will also build the airborne equipment necessary to determine the ground speed. Flight tests will be conducted by the Speckled Trout C-135C flight test aircraft under the wind shear support program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, NONLINEAR ANALYSIS AND DESIGN OF SUPERSONIC AIRCRAFT

M. Sinclari, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF140820; F33615-77-C-3126)

A more accurate method for analyzing advanced supersonic aircraft configurations over a wide range of flight parameters is required beyond the present linear methods. The non-linear analysis/design methods will enable handling realistic future military type aircraft geometries. There will be significant acquisition cost savings due to the accuracy and the reliability of the method. The objective of the effort is to generate a user-oriented computer code that gives the aerodynamic parameters of interest and detailed flow field characteristics around the aircraft. Military aircraft not only will have complex geometries but also operate over a wide range of flight parameters. These problems are non-linear in nature and therefore non-linear methods are required to generate reliable data useful for designers.

Cross-sectional geometries of aircraft will be transformed conformally into simpler shapes such as circles and rectangles, and the appropriate non-linear Eulerian equations will be solved by finite difference techniques. Reliability of the schemes will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, LOW COST RPV TECHNOLOGY DEMONSTRATION - AIRFRAME
D.M. Winkeljohn, Centro Corp., *1934 Stanley Ave., Dayton, Ohio* 45404 (DF142960; F33615-78-C-3012)

The mini-RPV concept is to provide an inexpensive unmanned carrier vehicle for such candidate missions as reconnaissance, ECM, target strike, and defense suppression. The objective of this contract effort is to develop and fabricate small scale airframes which, when mated with GFE avionics and payloads, will demonstrate the mini-RPV utility for such missions. This work contributes directly to the flight demonstration of mission capabilities which could provide military strategists and tacticians with low cost alternatives to currently planned equipments.

Candidate mini-RPV payloads are radar tracker, acoustic tracker, and ecm package. Contractor will develop and fabricate several small scale flight vehicles to serve as demonstration test beds for these payloads. Additionally, the contractor will develop and fabricate molded polyfoam airframes to establish suitability and cost base. Existing components and designs will be used to maximum practical extent except that special emphasis will be given to minimizing production costs of any possible future large scale procurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, TURBINE ENGINE INTEGRATION ANALYSIS PROCEDURES
E.G. Blevins, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF452670)

To generate the propulsion system (inlet, engine, exhaust) performance trends and establish the engineering techniques necessary for improving delivered thrust-fuel flow characteristics during engine part-power operation.

Generate time-phased analysis and test techniques that forecast elemental propulsion system performance to defined levels of accuracy. identify critical tests that must occur to define exhaust system/engine performance intereffects. Identify engine and exhaust system internal changes that are necessary to maximize delivered thrust at low throttle ratios.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0021, AUXILIARY POWER UNIT (APU) LABORATORY
P.G. Colegrove, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458270)

To develop and operate an in-house capability to test either contractually developed APU components or develop new APU concepts, to provide quick reaction response to requests for technical assistance and problem solution from using Air Force organizations such as SPO's and other laboratories.

Build and maintain suitable laboratory facilities for conducting tests on APU components or concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0022, WIND SHEAR SUPPORT PROGRAM
J.E. Christensen, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143470)

This work unit is the Air Force part of a joint USAF/FAA effort in wind shear research under interagency agreement DOT-FA70WAI-173, Modification 16. This combination of resources allows both organizations to supplement each other by exploiting their special capabilities and expertise to address the wind shear problem. In recent years, wind shear has been identified as the probable cause of a number of civilian and military aircraft accidents in the landing and takeoff phases of flight. Data compiled by the Air Force Inspection and Safety Center reveals that from 1965 through 1974, 41 probable shear/vortex related terminal area accidents cost the Air Force over 18 million dollars (multi-command ROC 501-76, 'Low-Altitude Wind Warning System'). Additionally, just as wind shear affects landings and takeoffs, it can also disrupt the accuracy of weapon delivery operations. Since the FAA has been designated as the lead agency for wind shear research, the Air Force will not develop a separate program, but will support the FAA through this cooperative effort. The objectives of this work unit are to develop, test and evaluate systems that provide to the flight crew, timely warnings of wind shear conditions, and to develop techniques for aircraft control through such conditions. The capability to reduce, or eliminate, the wind shear hazard to aircraft operations will increase the probability of successful mission accomplishment.

The Speckled Trout flight test aircraft will be used to test and demonstrate experimental wind shear systems. Present systems under development include wind shear sensors, displays, and telementry systems to aid the aircrew during flight operations. Additionally, the test aircraft, with its inertial navigation and data acquisition systems, will be used to verify wind shear forecasts at selected locations. All testing will be done on a non-interfering basis and will be scheduled around the Speckled Trout operational commitments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, WEAPON CARRIAGE AND SEPARATION TECHNOLOGY
R.L. Clark, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144800)

The Air Force function for this effort is to investigate advanced weapon/airframe integration for future high performance systems. External carriage of weapons by supersonic aircraft generally degrade their performance severely while internal carriage increases the weight and volume of such aircraft. The objective of this effort is to develop and experimentally evaluate advanced carriage concepts which will minimize the performance, weight, and volumetric penalties associated with advanced external and/or internal weapons carriage. Emphasis on reducing the detectability of penetrating aircraft will result in carefully integrated external or internal weapon carriage concepts. These designs may have unique weapon separation characteristics, and these will be investigated during this effort. Improved analysis methods for predicting weapon/airframe interference and weapon separation characteristics will be evaluated when available. Expected benefits of the effort include improved penetration capability and improved supersonic weapon carriage.

Advanced missile configuration aerodynamic data is available from several recent programs. The ability to theoretical methods to predict the results is deficient. In this effort the source of the deficiencies will be identified and new rapid methods will be derived to produce accurate results over a wide range of shape variations. The principal area of concentration will be to develop an analytical method to predict surface pressures on lifting body shapes at angles of attack to 35 degrees and Mach numbers from 2 to 8.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, BASIC RESEARCH IN STRUCTURES AND DYNAMICS
J.J. Olsen, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141950)

This work unit supports the technical base functions of the Structural Mechanics Division of the Air Force Flight Dynamics Laboratory. It addresses the problem areas of transonic unsteady aerodynamics, flutter, aeroelastic optimization and integration of aeroelastic disciplines. The goal is to create a numerical, analytical and experimental array of techniques to integrate the aeroelastic design, analysis and testing of aircraft structures to reduce the cost of design, acquisition and operation of new aircraft. This work unit will obtain substantial improvements in our ability to design, analyze and optimize aircraft structures for unsteady aerodynamic forces, vibrations, flutter, loads and aeroelastic control system interactions.

Initial developments will include the development of a three dimensional transonic unsteady aerodynamic computer

program for flutter applications. Finite element structural programs will also be modified to automate the input of data and the presentation of results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, OPTIMIZATION AND DAMAGE ASSESSMENT OF AEROSPACE STRUCTURES
G.R. Noland, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF143420; F33615-79-C-3209)

Significant reductions in weight and improvements in performance of aerospace structures can be achieved by judicious adoption of optimization in airframe design. However, to realize these benefits a well planned test program in conjunction with the development of efficient analytical methods is necessary to validate the optimized structures under service conditions. The objective of this effort is to transition theoretical developments in structural optimization into practical design tools so that significant cost reductions can be achieved in the design of future aerospace vehicles.

Using finite element methods and efficient optimization techniques a test plan will be developed for validation of optimized structures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, TRAINING PROGRAM IN COMPUTATIONAL FLUID DYNAMICS
B. Lakshminarayana, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NGT 39-009-802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

1.0027, JETWING FLIGHT EVALUATION
R.D. Kimberlin, University of Tennessee, Knoxville Campus, Graduate School, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DN890271; N00019-80-C-0126)

The Ball-Bartoe jetwing is an advanced aircraft concept wherein the entire efflux from the turbofan propulsion system exists through slots in the upper surface of the wing. The concept promises higher lift capability resulting in shorter take-off and landing requirements, increased maneuver capability and reduced noise signatures. The objective of this effort is to conduct engineering flight tests of this unique aircraft sufficient to evaluate the jetwing concept for potential application to future Navy aircraft.

The aircraft will be instrumented and engineering flight tests will be conducted to evaluate high lift potential, aircraft performance, static and dynamic longitudinal and lateral-directional stability, maneuvering stability, roll control power and landing approach handling qualities.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0028, CONVERSION OF FLIGHT RECORDS
E.K. Williams, Hampton Inst., Graduate School, Dept. of Mathematics, *Hampton, Virginia* 23368 (NAS 1-16429)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0029, HT PP 78-10 INVESTIGATION OF CANDIDATE THRUST PRODUCING SYSTEMS FOR FUTURE ARMY AIRCRAFT
J. Gomez, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3813; N/A)

To define advanced thrust producing systems which may provide significant helicopter and fixed wing aircraft improvements in order to identify future research.

1. Review and summarize past thrustor concepts including advantages and disadvantages of each. 2. Review future Army aircraft requirements and their related mission requirements. 3. Identify thrustor systems with potential to accomplish required missions. 4. Define scope of work required for each thrust device.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0030, AIR TRANSPORTATION SYSTEMS RESEARCH
A.R. Kugitman, University of Virginia, Graduate School, *Garrett Hall, Charlottesville, Virginia* 22903 (NAS 1-16286)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0031, INTEGRATED AIRCRAFT FUEL TANK INERTING/COMPARTMENT FIRE SUPPRESSION SYSTEMS
T.T. Tsue, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF463520; F33615-79-C-2027)

To examine feasibility of nitrogen-enriched air as a fire suppressant. To conduct penalty trade evaluation of nitrogen enriched air fire suppression system. To analyze advanced optimum integrated subsystem design.

Establish nitrogen-enriched air concentration levels required for extinguishment of aircraft liquid combustible material fires. Emphasis on dynamic laboratory scale testing complemented by selected dynamic, large scale, simulated aircraft compartment tests. Develop design, performance, trade-off and preliminary comparative IGG studies for integrated fire protection systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0032, INVESTIGATION OF MODELING CONCEPTS FOR PLUME AFTERBODY FLOW INTERACTIONS
S.E. Nyberg, Flygtekniska Forsoksanstalten, *Box 11021, Bromma, Sweden* (DA0D9390; DAERO 78 G0028)

The technical objective of the research effort is to experimentally verify the validity of the theoretical plume-afterbody flow field interaction modeling methodology developed by Korst.

Experimental results form wind tunnel tests with jet plume flow simulated with cold air and with heated freon will be compared. The experiments will include studies of plume shape effects on base pressure, separation position and pressure distribution on conical and cylindrical afterbodies. Parameters which will be varied are free stream and jet Mach numbers, afterbody cone angle, angle of attack and jet to free stream pressure ratio.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, ANALYSIS OF SATELLITE NAVIGATION SYSTEMS
B.E. Schutz, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Satellite navigation is now used extensively for surveying and point-positioning applications. These systems use the U.S. Navy Transit Satellite; however, the next generation system -Global Positioning Satellite - has entered check-out and validation. To evaluate the hardware and software requirements for various applications as well as to introduce state-of-the-art astronautical systems into the classroom, a JMR-1 Doppler positioning system has been acquired. Integra-

tion of this hardware with a computer system is proceeding in this continuing research and will provide real-time satellite tracking capability for laboratory applications and systems analysis.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, DYNAMIC MECHANICAL PROPERTIES AND FAILURE OF PARTICULATE COMPOSITE MATERIALS
Y.M. Gupta, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DN875615; N00014-78-C-0549)

The objective is to determine the response of a particulate composite material to dynamic loading conditions of combined compressive, shear and tensile stresses including determination of the surface area and porosity of the damaged material. This knowledge when available as a function of the material properties and internal geometry of a particulate composite will guide the future development of less hazardous propellants and explosives subject to the deflagration to detonation transition.

High strain rate mechanical properties of highly loaded particulate composites in addition to surface area to volume and porosity measurements of damaged material will be made. The effects of combined shear, compressive and tensile loading will be determined using a newly developed experimental technique of impacting inclined flyer plates with the parallel faces of the particulate composite into which particle velocity gages have been imbedded. The particle velocity data, compact velocity data, angle of flyer plate to sample inclination and the known shock characteristics of the flyer plate are used to detemine the high strain rate characteristics of the material. Surface area to volume and porosity data will be determined using krypton absorption and mercury porosimeter measurements respectively.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, GROWTH OF LARGE SINGLE CRYSTALS OF GaN
W.A. Tiller, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DN890057; N00019-79-C-0327)

The achievement of a device suitable for wide band-gap material such as GaN would open new opportunities for high temperature transistor-like devices and also blue-green LED's and lasers in military systems. As a research effort leading to the potential device exploitation of this material the primary objective of this effort will be to study in depth the existing information concerning the preparation and properties of GaN single crystals and to study the applicability of several new techniques toward the growth of large crystals.

The experimental study of the growth of single crystals of GaN will employ both a horizontal and vertical temperature gradient system. Efforts will be made to control the vapor pressure of GaN in the gas phase so that seed crystals can be grown at higher temperatures without decomposition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0003, IN (X) GA (1-X) AS (Y) P (1-Y) MATERIALS RESEARCH FOR INFRARED DETECTOR APPLICATION
A.R. Clawson, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN587579)

To investigate the preparation and properties of the quaternary semiconductor alloy indium (x) gallium (1-x) arsenide (y) phosphide (1-y) for infrared applications in the 1.0 to 1.3 micrometer wavelength region. To study P-N junction structure for their properties suitable to be used for electro-optical detectors for Navy fiber optics communications systems.

This work is closely coordinated with research and development on optical fiber communications and is intended to provide materials for detectors for such applications. It is concerned with growth and characterization of indium (x) gallium (1-x) arsenide (y) phosphide (1-y) by liquid-phase epitaxy lattice-matched to indium phosphide substrates to minimize detrimental crystallographic strain and defects and with appropriate doping to form P-N junction detectors. Adjustment of the alloy composition will provide both the lattice match and the appropriate bandgap for response at a specific wavelength between 0.92 and 1.66 micrometers.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Research Admin.

3.0004, CLUSTER VARIATION STUDY OF COHERENT ORDERING IN FCC AND BCC SOLID SOLUTIONS - 16964-MS
D. de Fontaine, University of California, Berkeley Campus, School of Engineering, Dept. of Materials Sciences & Mineral Engineering, *Berkeley, California* 94720 (DA0G3055; DAAG29-80-K-0044)

To calculate coherent phase diagrams for FCC and BCC ordered superstructures using the cluster variation method. Relevance: The research has long range relevance to development of alloys. Coherent ordered phases are important in precipitation hardened alloys (principally aluminum alloys) which are used in Army aircraft, armored personnel carriers, bridging, etc.

The program will include, determination of the ground-state structures for pair and many body interactions, and modelling the coherent phase diagrams for Ni-Mo and Ni-V, the Au-Cu phase diagram using higher order terms, ordering wave instability and spinodal ordering, and the Fe-Al system as an example of BCC based superstructures in which magnetic interactions are present.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0005, SURVEILLANCE - INTERACTION POTENTIALS
Y.T. Lee, University of California, Berkeley Campus, School of Letters & Science, Dept. of Chemistry, *Berkeley, California* 94720 (DN775123; N00014-77-C-0101)

The objective of this work unit is to determine interaction potentials between rare-gas atoms and halogen atoms. Information generated by this project will be helpful in the development of rare-gas halide lasers and contribute toward Navy requirements for optical surveillance, reconnaissance, communication and tracking systems.

To accomplish the proposed objective, high resolution measurements of elastic differential cross sections as a function of collision energies are being made using crossed molecular beams. Experiments are being done for XeF, KrF, ArF, and NeF.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, IDENTIFICATION OF FLAWS IN HIGH PERFORMANCE CERAMICS
G.H. Sines, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials, *405 Hilgard Ave., Los Angeles, California* 90024 (DF049820; AFOSR-77-3425)

AF function - ceramic electromagnetic windows for radar and target acquisition allow combat aircraft to operate in all weather conditions. Deficiency - ceramic windows are, however, subject to brittle fracture originating from preexisting defects. Objective - the objective of this research is to identify the source and character of the defects which lead to mechanical failure in ceramic components. How work contributes -identification of the sources of failure is necessary in order to design nondestructive evaluation (NDE) techniques to find and reject components having unacceptable preexisting defects.

An eccentrically loaded column bend test will be developed to enable a number of small cracks (equivalent to 20) to grow without catastrophic failure occurring from just one worst flaw. The selective nature of slow crack growth from certain categories of flaws will be determined. New techniques which permit

the identification of many flaws (greater than 10 to the 4) from the study of microspallation of a single compressively loaded specimen will be correlated with tensile fracture initiation sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, CHEMICAL ENERGY STORAGE

R.N. Hazlett, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880122)

The purpose of this research is to determine how N-alkanes in the jet fuel range are formed in the thermal processes used to produce liquid fuels from shale oil, coal and tar sands. A further objective is to suggest variations of thermal processes or refining procedures which will result in a lower concentration of N-alkanes, thus relieving the jet fuel freezing point problem.

The original resource material will be analyzed to define the potential for N-alkane formation. Then thermal processes such as, pyrolysis, delayed coking and hydrogenation will be examined by varying system parameters such as temperature, pressure and time. Model compounds will also be subjected to pyrolysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0008, RESONANCE IN MAGNETIC MATERIALS

J.J. Krebs, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620114)

The efficient design and operation of naval radar, electronic and communication devices are limited by the characteristics of their magnetic and electronic components. This work is aimed at providing detailed information on the properties of selected materials. The effects of magnetic and electric fields are studied to aid in the development and improvement of technologically important magnetic and electronic materials.

Study magnetic ions and materials with a view to predicting and controlling their behavior in bulk samples. A variety of spectroscopic techniques including electron paramagnetic resonance (EPR) and nuclear magnetic resonance (NMR) are used to probe magnetic ions and their surroundings. Experiments over a wide range of temperatures and frequencies are used to extract the important parameters which govern the properties of these materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0009, MODELING AND MODIFICATION OF THE ELECTROMAGNETIC PROPERTIES OF ADVANCED COMPOSITE MATERIALS

W. Gajda, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (DF050250; AFOSR-77-3453)

AF function - recent increased use of composite materials in AF systems has required knowledge of the electrical properties of such materials. The vulnerability of the aircraft with composite components to nuclear EMP is of importance. The vulnerability is determined, in fact, by the conductivity of the composite materials. Opportunity - this research will provide basic information useful in assessing the survivability of AF systems with composite components. Objective - the objective of this study is to understand the nature of selected advance composite materials and to subsequently develop materials with desired properties. Contribution - this research will contribute to the basic knowledge of the properties of composite materials.

This investigation will approach the goal of modification the electrical properties of advanced composite materials by - (1) developing doping techniques to increase the conductivity of fibers used in composite materials, and (2) formulating models based upon statistical theory of random media to allow prediction of conductivity and permittivity of fiber reinforced material.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, SYNTHETIC AND MECHANISTIC STUDIES IN FLUORINE CHEMISTRY - 14339-C

D.D. Desmarteau, Kansas State University, School of Arts & Sciences, Dept. of Chemistry, *Anderson Hall, Manhattan, Kansas* 66502 (DA0F8931; DAAG29 77 G0071)

To explore the chemistry of pentafluoroselenium peroxygen compounds, fluorinated small ring heterocyclic compounds, and oxygen-fluorine compounds. Relevance: Fluorides of certain non-metals are very energetic, highly oxidizing, while those of others are highly stable. New examples and new methods to obtain new and familiar ones could have implications for oxidizer technology for rocket propulsion and for especially stable fluorinated materials.

The synthesis of pentafluoroselenium hydroperoxide will be attempted. The mechanism of perfluoroxazirine formation will be investigated and its chemistry exploited for the synthesis of other related compounds. New methods to prepare oxygen-fluorine compounds will be developed, and their use as fluorinating agents evaluated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0011, AMORPHOUS IRON BORIDES - PREPARATION, STRUCTURE AND MAGNETIC PROPERTIES - 15344-P

N.A. BLum, Johns Hopkins University, Graduate School, *Laurel, Maryland* (DA0G8974)

To investigate the magnetic aspects of amorphous iron boride. Relevance: Metallic glasses in general and iron borides in particular have unique properties of importance to the Army. Iron boride in the 80/20 alloy is presently being investigated as a shielding material for transients in color video displays at the ET and DL. Other applications include transformer cores and inductive devices below one megahertz.

From Mossbauer spectra, the primary diagnostic tool in these studies, the electromagnetic environment of the resonant atom and information concerning lattice vibrations will be derived. Samples will be prepared by code position in vacuum. Materials will be characterized by X-ray diffraction secondary ion mass spectroscopy (SIMS), electronic beam microscopy and X-ray energy spectroscopy prior to study by the Mossbauer techniques. Existing theoretical models will be modified to enhance their applicability to the system under study.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0012, APPLICATION OF MODERN METHODS OF STATISTICAL MECHANICS TO THE PERCOLATION PHENOMENON - 15750-P

H.E. Stanley, Boston University, School of Arts & Sciences, Dept. of Physics, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (DA0G8931; DAAG29-79-G-0002)

To develop percolation theory to a level of sophistication that allows its use in a number of Army applications. Relevance: The research is potentially relevant to ongoing work on composites, particularly in areas of graded metal-ceramic armor, airfoil noise reduction, reduction of blast damage and related phenomena. It may prove important to other phenomena such as crack propagation, chemical reactivity, resistance to wear, printed circuit wiring, and phenomena in solid state physics such as semiconductor-metal transitions.

Modern methods of statistical mechanics, such as the renormalization group method and fractal dimensionality, will be used. Equations of state near the percolation threshold will be derived. Six generalizations of the classical percolation problem will be constructed and solved involving correlation, anisotropy, further-than-nearest-neighbors interaction, chains, and site-bond combinations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, MICROSTRUCTURE AND PROPERTIES OF POWDER-PROCESSES ALUMINUM-LITHIUM ALLOYS
S.M. Sastry, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF054940; F49620-79-C-0039)

Af function - the use of Al-Li alloys in aerospace structures provides the potential for weight and life-cycle-cost reductions. Opportunity - additions of Li to Al, Al-Cu and Al-Mg alloys have resulted in a considerable improvement of strength/weight and stiffness/weight ratios, with each weight per cent Li resulting in a 3 per cent reduction in density and a 6 per cent increase in Young's modulus. Alloys based on the Al-Li system are thus capable of developing unique and attractive combinations of high specific strength (10 per cent increase) and high specific modulus (10 per cent increase), thereby enabling potential weight savings in aircraft structural members. Objective - this research provides a systematic investigation of deformation and fracture characteristics of Al-Li alloys to identify beneficial alloying elements and microstructures, and to provide guidelines for the systematic development of rapid quenching and powder metallurgical methods for producing Al-Li alloys. A potential exists for improvements in the ductility and toughness of Al-Li alloys by the slip homogenization that can be effected by grain refinement and by ancillary element additions to provide a controlled dispersion of incoherent dispersoids. How work contributes - Al-Li alloys can provide significant weigh savings and life-cycle-cost reductions compared with existing aluminum alloys and composite materials in forward and aft fuselage structures and upper wing covers. Li-containing aluminum alloys presently processed by conventional casting methods have unacceptable ductility and toughness.

The program is divided into three phases. In phase I, a systematic investigation of modifications in microstructures and properties effected by rapid quenching and addition of ancillary alloying elements to binary Al-Li alloys will be conducted. In phase II, the optimum ancillary alloying elements selected from phase I will be added to Al-Cu-Li, Al-Mg-Li, and Al-Zn-Mg-Cu-Li alloys, and alloy powders will be produced as flakes and spherical powders by three different rapid-solidification techniques. The properties of the alloys as influenced by the powder type, consolidation and processing parameters will be studied. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, PROPELLANT EVALUATION TESTING
F. Thomas, Montana State University, School of Letters & Sciences, Dept. of Chemistry, *Bozeman, Montana* 59715 (DF144990; F33615-79-C-3410)

In order to evaluate vulnerability reduction techniques for present and future AF aircraft it is necessary to duplicate the anticipated threat effects induced by ballistic impacts. This is done by conducting controlled tests in a laboratory environment. In these tests, aircraft components are impacted with various threats in a realistic flight environment in the AFFDLS aircraft survivability research facility (ASRF). The threats simulated are various caliber HE and AP projectiles and multiple fragments produced by missile warhead detonations. In order to accurately control the velocity of fragments and projectiles during ballistic testing, it is necessary to have a thorough knowledge of the characteristics of various propellants. The objective of this program is to experimentally characterize a variety of commercially available propellants. The data obtained can then be used to develop higher velocity launching techniques and more repeatable launch velocities. This is part of a program whose overall goal is to upgrade simulation capabilities at the ASRF. The results of these tests will not be utilized by the government for any offensive weapons system development.

This effort entails the setup, testing and data reduction required to experimentally determine the burning rate of 62 or more powder propellants. The test setup shall follow the procedures of MIL-STD-286B, Method 801.1. The data to be submitted to the procuring activity as a result of the performance of these tests are the pressure-time traces produced by the furnished equipment and the calibration data necessary to interpret these traces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0015, CONTROLLED GRAIN BOUNDARY STRUCTURES IN SUPERCONDUCTORS
E.J. Kramer, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DF037890; AFOSR-77-3107)

AF function - high temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the aim of this research is to investigate the synthesis of superconductors with controlled grain boundary microstructures and to explore the characterization of flux pinning due to this controlled microstructure. Experiments on bicrystals and films are designed to establish which of the basic interaction mechanisms such as, the upper critical magnetic field anisotropy interaction, grain boundary stress field interaction, electron scattering interaction or the electron scattering interaction enhanced by solute segregation, is dominant in developing an elementary interaction force between the flux line lattice and grain boundaries in superconducting materials. How work contributes - for many potential applications the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current carrying capacity and the critical transition temperature of the superconducting material could be enhanced.

Several different approaches to synthesizing the optimum controlled grain boundary sample are being investigated. Microscopic bicrystal superconductors are being grown by electron beam float zone techniques from two crystal seeds. These bicrystals will include grain boundaries with either tilt or twist orientations. The pinning force density in samples having only grain boundaries with a single misorientation angle and character (tilt or twist) will be measured. These boundaries will be characterized using electron microscopy and x-ray topography. The microstructure will be explored by decoration techniques and the constitution of the grain boundary will be studied by chemical methods to differentiate between the electron-grain boundary scattering interaction and the impurity atom segregation interaction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0016, YTTRIUM PHOSPHATE CRYSTALS
W. Zwicker, North American Philips Corp., *345 Scarborough Rd., Briarcliff Manor, New York* 10510 (DN975379; N00014-79-C-0180)

Optical quality crystals of yttrium phosphate would be useful as polarizers in naval electrooptical systems.

The contractor will attempt a scale up, to cm size, crystals of yttrium phosphate. Similar growth techniques with the same furnaces will be tried for thorium oxide.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, MOLECULAR BEAM STUDIES OF CHEMICAL DYNAMICS USING SHORT-LIVED RADIOACTIVITY AND SYNCHROTRON LIGHT
J.R. Grover, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (COKC13; AC02-76CH00016)

A user-oriented windowless experimental facility for gas phase studies is being designed and built for interfacing with the NSLS. The planned BNL use of this facility features a nozzle molecular beam apparatus in which strongly cooled molecules, radicals, and clusters are studied by mass spectrometry utilizing the tunable vacuum ultraviolet radiation for photoionization. Long-term prospects include a unique crossed beam capability for measuring angle-differential cross sections, plus detailed energy disposal patterns, for elementary reactions involving four or more atoms and multiple reaction pathways. A crossed molecular beam technique having one of the reagent beams labeled with a short-lived (less than or equal to 10/sup -1/ sec) radioac-

tive isotope is being used to measure absolute differential cross sections for reactive scattering. This technique has a sensitivity many times that attained in other crossed beam experiments. The prototype experiments comprise a thoroughgoing investigation of the reactions of HAc using the short-lived nuclide 217Ac, for which t/sub 1/2/ = 0.032 sec. Results to date indicate that extension of this technique to accelerator-produced isotopes would allow reactive cross sections as small as 10/sup -5/ A2 to be subjected to differential study. This capability would open up whole new classes of reactions for crossed beam investigations. The basic goal of this work is to provide definitive experimental determinations of reactive potential hypersurfaces, to test and calibrate semiempirical theories now under development.

BIBLIOGRAPHIC REFERENCES: Grover, J.R., and J.B.A. Mitchell, A Versatile User-Oriented Atomic and Molecular Beam Apparatus for Use with the National Synchrotron Light Source, pp. 302-303 in Proceedings of Seventh International Symposium Molecular Beams, Riva del Garda, May--Jun 1979. Grover, J.R., R.B. Klemm, J.B.A. Mitchell (eds.), Report of Workshop on Windowless Gas Phase Beam Line at the National Synchrotron Light Source, BNL-27004, 29 June 1979.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0018, IMPROVED MOISTURE RESISTANCE OF FIBER REINFORCED PLASTICS - 14740-MS

J.L. Koenig, Case Western Reserve University, School of Engineering, Dept. of Macromolecular Science, *University Cir., Cleveland, Ohio* 44106 (DA0F9264; DAAG29-80-C-0136)

To study the chemical reactions induced by water vapor at the interfaces in fiber reinforced plastic composites, and to relate these results to mechanical performance of the composites. Relevance: The research is relevant to the environmental deterioration of epoxy matrix composites which are used in Army aircraft, missiles, and packaging for shipping of material. This deterioration is reportedly the number one materials problem for Army aircraft.

Study moisture attack on the untreated surface of glass fibers using vibrational spectroscopy. Study the reactions of coupling agents with glass surfaces to determine optimum conditions for coupling. Study the chemical changes caused by the presence of moisture in the coupling agent, glass surface, and adjacent matrix. Measure the mechanical properties of the composite in various stages of exposure to moisture.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0019, INVESTIGATIONS OF GAS-PHASE COLLISION DYNAMICS

L.M. Raff, Oklahoma State University, Graduate School, Dept. of Chemistry, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (CHE78-25563)

This grant supports rsearch under the Quantum Chemistry Program for theoretical investigations of gas-phase collision dynamics. Theory plays an important role in interpreting chemical reaction rates which are now measured by elegant experiments using lasers in combination with molecular beams. Although much is known about atom-diatom collision processes, many unanswered and important questions exist when polyatomic reactants are involved. This is precisely the area in which Professor Raff will concentrate his efforts.

The part played by vibrational excitation in enhancing reaction rates of polyatomic reactants is understood poorly. Some molecules become more reactive upon internal excitation by multiphoton absorption and others do not. Professor Raff will investigate this puzzle by performing scattering calculations in which the topological features of potential energy surfaces are varied (e.g., saddle-point position, and curvature, nature of the inner repulsive wall) as a function of the level of excitation. An aim of this research is to learn how these microscopic details lead to the overall observed data.

This is a renewal of research currently supported by NSF grant CHE7518967 at Oklahoma State University.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0020, THEORETICAL STUDIES IN CHEMICAL PHYSICS

D.R. Herrick, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Chemistry, *1472 Kincaid St., Eugene, Oregon* 97401 (CHE79-09500)

This grant supports research under the Quantum Chemistry Program to study symmetry effects of electronic states in atoms and molecules. When the motions of electrons are highly correlated, the usual classification scheme for ground or excited states becomes inadequate, leading to apparent anomalies and difficulty in the interpretation of experimental data. Professor Herrick's research is essentially concerned with clarifying this situation by group theoretical analysis of the interaction between electron pairs. Three related areas involving strong mixing effects and autoionization will be investigated: (1) Multiply-excited states and few-body correlations, and the extent to which near-degeneracy mixings and new energy level clustering effects are governed by Lie algebras, including doubly-excited states, leading to the two-electron photodetachment threshold of negative ions; (2) High-Rydberg states, especially angular momentum transfer mechanisms and strong state-mixing by electron collisons, the Stark effect, and atomic diamagnetism; (3) New computational approaches to complex energy variational methods and resonances, including effects of vibrationally excited diatomic Rydberg states and narrow-width transmission models for quasi-one-dimensional semiconductors. An objective of part of the research is to help provide more efficient design of semiconductor devices.

This is a renewal of research currently supported by NSF grant CHE7610332 to the University of Oregon at Eugene.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0021, GRAIN BOUNDARY PINNING OF FLUX LINES IN NIOBIUM BICRYSTALS

Y.T. Chou, Lehigh University, School of Engineering & Physical Science, Dept. of Metallurgy & Materials Science, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DMR79-15799)

This is a fundamental study of grain boundary flux pinning in niobium bicrystals. Oriented bicrystals will be grown directly from the melt, and the segregation of impurities of the grain boundary will be determined by Auger analysis. The bicrystals will be used as a model material to measure resistive current as a function of the applied magnetic field and the angle between the field and the grain boundary. The critical current measurements will be done at the Oak Ridge National Laboratory, in collaboration with Dr. DasGupta.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0022, STUDIES IN X-RAY AND PHOTOELECTRON SPECTROSCOPIES

R.L. Watson, Texas A & M University, College Station Campus, School of Science, Dept. of Chemistry, *College Station, Texas* 77843 (A-355)

The spectra of K alpha X-rays produced by 1 to 3 MeV/amu H, He, O, and S ion bombardment of magnesium and some of its compounds have been measured. The energies and intensities of the KL1, KL2, and KL3 satellite multiplet components were determined and compared with detailed Hartree-Fock energy calculations and with intensity calculations based upon a statistical population of states and theoretical fluorescence yields. It was found that large intensity changes occur among certain of the multiplet components in going from Mg metal to MgO. Also a strong dependence of multiplet intensity ratios on projectile atomic number was observed.

In another investigation, aimed at observing the influence of the Coulomb field of a slowly receding electron on the Auger decay of selenium ion following L2 photoionization, the LMM Auger spectrum was measured for a variety of compounds near the L2 ionization threshold using monchromatic Al K alpha radiation. As a result of 'post-collision' interaction, the energy difference between the L2MM and the L3MM Auger peaks increased by as much as 1.1 plus or minus 0.1 eV. The energy shifts were compared with the predications of semiclassical analysis and indicated that extra-atomic relaxation must be accounted for in solids.

SUPPORTED BY Robert A. Welch Foundation

3.0023, LASER SPECTROSCOPY OF IONS IN THE GAS PHASE

M.L. Vestal, University of Houston, School of Natural Sciences & Mathematics, Dept. of Chemistry, *3801 Cullen Blvd., Houston, Texas* 77004 (D-693)

The tandem quadrupole mass spectrometer has been mated with a new laser system consisting of a tunable dye laser pumped by a 400 KW pulsed nitrogen laser. This laser system provides continuous coverage of the spectrum from 360 to 750 nm with a bandwidth of 0.4/cm. Experimental measurements of photodissociation cross sections for the rare gas dimer ions such as Ar2 plus and Ne2 plus are currently in progress. In addition to spectroscopic investigations on the electronically excited states of ions, the present studies should provide data on collisional relaxation of specific vibrational levels of the ground electronic state. The instrument has recently been modified to allow investigations of laser photodetachment of negative ions as well as the photodissociation measurements conducted previously. This new capability is presently being applied to studies on competitive autodetachment and predissociation of laser excited CO3 ions formed in CO2 and CO2/O2 mixtures.

SUPPORTED BY Robert A. Welch Foundation

3.0024, SOLIDIFICATION OF HIGHLY UNDERCOOLED LIQUID DROPLETS - 17455-MS

J.H. Perepezko, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Metallurgical Engineering, *Madison, Wisconsin* 53706 (DA0G3467; DAAG29-80-K-0068)

Investigation of phase selection kinetics and microstructural evolution during solidification of non-equilibrium metastable metals of highly undercooled and hypercooled melts. Relevance: This investigation is relevant to ongoing efforts at Benet Weapons Lab, FC&SCWSL and AMMRC in nonequilibrium materials for high temperature service in armaments, for new generation aluminum structural alloys for aircraft, armaments, and munitions, for gear materials for helicopters and armored vehicles, and at ERADCOM for magnetic materials used in transformers.

This research will include: 1. Utilization of the liquid-emulsion droplet techniques to examine metastable phase reaction kinetics by differential thermal analysis. 2. Investigation of the effect of pressure on the formation and stabilization of metastable phases. 3. Development of the droplet-convulsion technique to include experimental methods for investigations above 500C, the current limit. 4. Investigation of the formation of amorphous phases and their subsequent compaction into bulk shapes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0025, CRITICAL BEHAVIOR OF MANY BODY SYSTEMS & POLYMERS (DA0E9407)

C. Domb, University of London, Kings College, *Strand, London, England, United Kingdom* (DA0G2892; DAJA37-80-C-0146)

To investigate: 1) percolating systems with positive or negative correlations between percolating particles; 2) configurational statistics of polymer chains; and 3) discrepancies between critical exponents as determined by series expansions and renormalization group.

Series expansions, application of the principles of smoothness and universality.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TERMINAL GUIDANCE TECHNOLOGY - GUIDANCE SYSTEM, INTEGRATION AND VERIFICATION

J.P. Leonard, U.S. Dept. of Defense, Army, Missile Research & Development Command, Guidance & Control Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0F1029)

To establish a validated technology data base on advanced terminal guidance techniques.

To evaluate and establish performance capabilities and limitations of advanced terminal homing guidance techniques and their hardware implementations by developing six degree of Frerdeom digital simulations, continually validating these simulations by utilizing available field target scene measurements data and performance data from breadboard prototype hardware components, utilizing these simulations to generate hardware specifications for procurement, developing hardware-in-the-loop simulations, conducting laboratory, captive and missile flight tests of prototype flightworthy hardware.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Advanced Sensors Directorate

4.0002, COHERENT IMAGING AND OPTICAL DATA PROCESSING

C.R. Christensen, U.S. Dept. of Defense, Army, Missile Research & Development Command, Missile Research Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1066)

Investigate the fundamental performance limiting features of coherent sensor systems used for missile fire control, beam riders, and seekers and develop optical data processing techniques for optical guidance systems and radar signal processing.

Assess coherent interference phenomena as they relate to the development of missile sensor technology in the far IR and MM spectral regions for all weather/smoke applications. This task also includes exploration of optical data processing techniques for correlation guidance, radar signal processing and radiation field pre-processing.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Missile Research Directorate

4.0003, NUMERICAL SIMULATION OF MAGNETICALLY CONFINED PLASMA

R.L. Morse, University of Arizona, School of Engineering, Dept. of Nuclear Engineering, *Tucson, Arizona* 85721 (872004; EG-77-S-02-4259)

Studies of energy loss processes in magnetically confined plasmas, principally linear and compact TORI systems, are being conducted by numerical simulation methods. Some analytic models are also being used. The object of most of these studies is to determine the conditions, including initial temperature and end plug material, required to achieve economical thermonuclear burn. During the past contract period hybrid codes developed to simulate high density, high-beta plasmas have been applied primarily to heating, ignition, and burn of linear reactor systems and to current profile steepening and related stability changes in TOKAMAKS. Some code development has also been done to incorporate Monte Carlo alpha transport and to make it possible to treat rotation and rotational instability in compact TORI and linear systems. Also, analytic expressions

for temperature profiles and heat loss caused by thermal conduction in compact TORI have been obtained.

SUPPORTED BY U.S. Dept. of Energy, Office of Magnetic Fusion Energy

4.0004, ANALYSIS OF STEADY AND UNSTEADY TRANSONIC FLOWS

A.R. Seebass, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (DF042730; AFOSR-76-2954)

AF function - advanced aerospace vehicles. Deficiency - lack of basic knowledge on how to calculate forces and moments on two dimensional and three dimensional configurations for both steady and unsteady flows that may, or may not, have boundaries simulating tunnel walls. Objective - develop a rapid and efficient method of calculation for steady and unsteady transonic flows. Analyze steady and unsteady small perturbation transonic flows with emphasis in the area of wind tunnel testing problems. How contributes - a better understanding of steady and unsteady transonic flows will enable us to include calculations of this type in the design process. It will also enable us to modify such designs on the basis of wind tunnel measurements.

Specialized computational procedures appropriate for steady and unsteady transonic flows will be further developed and extended to new cases. Emphasis will be placed on the extension and further demonstration in three dimensions of the new shock-free design procedure using fictitious equations. The potential utility of the procedure relative to inverse methods and numerical optimization techniques will be assessed. An attempt will be made to extend the previously developed time linearized algorithm for transonic unsteady flow to three dimensions, eliminating the need for shock fitting in the steady state computation. A numerical simulation will be undertaken of a three dimensional smart wall wind tunnel concept which provides both monopole and dipole variations in the porosity with simple geometric changes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, ELECTRET TAPE SENSOR DEVELOPMENT

G.K. Miller, GTE Sylvania Inc., *Mountain View, California* (DF738980; F30602-78-C-0320)

The objective of this effort is to investigate and demonstrate a technique for the development of a line sensor that can be applied like tape to fences, interior and exterior building walls, aircraft skins, etc. The concept to be demonstrated is basically an active ultrasonic doppler system using electret layers in the tape as radiating and receiving elements.

The results of previous work recommended that a dual system comprised of two electret strips fabricated on one substrate would be the most advantageous configuration for long transducer lengths. The approach for achieving the objective will be as follows: a) Identify the optimum design for the dual system configuration. B) Fabricate samples of the design considered optimum and measure radiation and receiving performance of this design. C) Modify the design based on the results obtained and have a laminated manufacture fabricate long samples for evaluation and delivery. D) Based on the final transducer design, design and fabricate the driving and receiving electronics which will then be integrated with the transducer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0006, RESEARCH INVESTIGATION ON C3 FOR NAVAL AIRCRAFT

R.C. Hansen, R.C. Hansen Inc., *Tarzana, California* 91356 (DN890180; N00019-80-M-0190)

Research investigation of the needs, deficiencies, and technical frontiers in communications, command and control (C3) technology.

Based upon the results of an earlier investigation a number of panels, consisting of experts from the technical community, will be formed for the purpose of forging an assembly of research thrusts to meet C3 application needs for the longer term future.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0007, MECHANISMS AND KINETICS OF DIPHTHALOCYANINE ELECTRODE PROCESSES

M.M. Nicholson, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DF058460; F49620-80-C-0060)

AF function - future Air Force operations require improved electro-optical and electronic materials for use in flight control, reconnaissance and surveillance, and signal processing and control devices. Deficiency - a need exists for new materials which can be exploited for the design of new concepts and classes of electro-optical devices. Objective - the objective is to determine mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanine complexes. How work contributes - the research will provide a new class of electro-optical materials which may find applications in visual displays, large-array memories, and other electronic devices.

The mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanines will be determined. The role of oxygen will be clarified, and that of water will be examined. The electrode kinetics study will be extended to include other conditions of current density and electrolyte composition. This will involve some electrochemical measurements on insoluble dye film in a nonaqueous liquid such as dimethyl sulfoxide.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, NUMERICAL VORTEX TRACING

O. Buneman, Stanford University, Inst. for Plasma Research, *Stanford, California* 94305 (DN875232; N00014-78-C-0272)

The development of accurate numerical procedures for predicting high Reynolds number flows will lead to improved methods for optimizing the performance of aircraft, ships, and missiles. The purpose of the proposed research on three-dimensional turbulence will be to develop a viable and accurate vortex tracing method which will be able to simulate, for special cases, the evolution of turbulence.

The basic approach of the proposed method is to represent the continuous distribution of vorticity in a flow field by discrete, closed, vortex filaments. In this model, viscous effects will occur only in the internal structure of the vortex filaments. Since viscous effects are neglected elsewhere, the vortex filaments move with the local fluid velocity. The velocity field is not calculated directly from Biot-Savart's law but by integrating a Poisson equation on an appropriate mesh. Once the velocity field is established, the fluid elements along each vortex filament are advanced in time to establish a new vorticity distribution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, IMPROVED FLOW VISUALIZATION BY USE OF RESONANT REFRACTIVITY

D. Bershader, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF054530; AFOSR-79-0058)

AF function - aerospace vehicles. Opportunity - Air Force flight operations depend on the science of aerodynamics for the quantitative prediction of performance and loads on vehicle surfaces, both for operational use and especially for rational design. Optical methods, viz shadowgraph, schlieren and interferometry, are important and long established tools of experimental aerodynamics. There is a need for obtaining highly increased sensitivity in these refractive optical methods. With the use of laser sources, resonant refractivity should provide this needed highly increased sensitivity in refractive optical systems. Objective - to develop a resonant refractive system for air and to demonstrate its use with a simple flow field. How work contributes -this work will investigate the feasibility of using the resonant refractivity of sodium or other vapor to enhance the sensitivity of optical flow measurements by a factor of 100.

Theoretical and experimental graduate study and post doctoral research are being done to provide a feasibility assessment and design recommendations for using resonant refractivity of sodium or other vapor to provide flow visualization for very weak refractive flows.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, X-RAY IMAGING SYSTEMS USING ENERGY SPECTRUM ANALYSIS

A. Macovski, Stanford University, School of Engineering, Dept. of Electrical Engineering/Radiology, *Stanford, California* 94305 (ENG78-23307)

This project represents a continuing effort at significantly improving diagnostic images through the use of energy spectrum information. Existing systems of radiography and computerized tomography record the transmission of various body structures to a broad spectrum of X-ray energies and, therefore, important information relating to the energy dependence of the materials is lost. In addition, the use of broad energy spectra causes significant distortions in computerized tomography. By using the energy spectrum information, additional capability for visualization of structures presently having visibility problems or where techniques are non-existent. In addition to removing artifacts, the use of energy data in computerized tomography provides separate images of the photoelectric or atomic-number dependent components and the Compton scattering or density dependent components.

This research is a continuation of a project previously supported under NSF grant ENG-7605529.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0011, ION IMPLANTATION IN INDIUM PHOSPHIDE

C. Zeisse, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN088727)

To develop an indium phosphide (InP) homojunction technology suitablefor microwave field-effect transistor (FET) power sources for EW and integrated circuits (ICS) intended for high-speed low power information processing systems and to extend the InP-based technology to optoelectronics applications.

Abrupt and shallow junctions on InP substrates will be made by ion implantation of silicon and beryllium into bulk semi-insulating InP; laser or thermal annealing will be used to activate the implanted impurities. Metallurgical, electrical and optical investigations will be made in order to evaluate qualitatively and quantitatively the properties of such conducting layers. Such layers will be used subsequently as the source/drain electrodes of unipolar transistors to be used in microwave-enhancement-mode FET power sources and ICS.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Command Control & Guidance Admin.

4.0012, FLUIDIC CONCEPTS DEVELOPMENT AND FLUIDIC BACKUP FLIGHT CONTROLS

T. Sarpkaya, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN098060)

To determine the feasibility of fluidic backup flight controls with emphasis on pneumatic fluidics and to develop new fluidic concepts.

Analytical and experimental.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0013, UNIVERSAL STOCHASTIC INSTABILITY IN THREE DEGREES OF FREEDOM

A.J. Lichtenberg, University of California, Berkeley Campus, Electronics Research Lab., *Berkeley, California* 94720 (DN975575; N00014-79-C-0674)

The Navy needs modern techniques and quantitative information on the nonlinear statistical behavior of plasmas for naval applications in communication systems, weapons effects and simulation and directed energy systems. In particular, the nonlinear oscillations of Hamiltonian systems will be studied and an understanding of the transition to ergodic and stochastic motion, which is generated by the dynamics in such systems, will be sought. This self-generated transition to chaotic motion offers the promise of a link, long sought, between dynamics and statistical mechanics. The related universal stochastic instability in systems with three degrees of freedom will be studied.

The approach is an analytic and numerical study of the self-generated stochastic motion of charged particles in the Earth's ionosphere and magnetosphere. The intent is to understand various phenomena concerned with the trapping of injected particles; the acceleration of particles, and the anomalous decay of trapped particles. The basic procedure will be to apply to the relevant dynamical problems the modern theory of the destruction of adiabatic invariants and the transition to chaotic motion in multidimensional nonlinear systems. The theory will be compared to numerical experiments in which the exact dynamical equations and simplified forms of these equations are integrated, and the resulting motion is calculated, over very long periods of time. Finally, comparison to experimental observations in the Earth's magnetosphere will be made.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0014, RESEARCH IN HIGH-ENERGY PLASMAS

A.J. Lichtenberg, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Science, *Berkeley, California* 94720 (ENG78-26372)

This research program involves the theoretical and experimental study of plasma creation, containment, and heating in magnetic mirror plasma device configurations. The research covers the following topics: A. Theoretical and experimental studies relating to adiabatic invariance and its breakdown, with applications to plasma trapping and containment. B. Theoretical and experimental study of axial feedback stabilization of flute modes in a low temperature, multiple mirror plasma. C. Study of cold plasma stabilization of hot-electron plasmas.

This is a continuation of research previously supported under NSF grant ENG-7809424.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0015, CARBON-CARBON PROCESSING STUDY

G. Sines, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DN775654; N00014-77-C-0505)

Carbon-carbon materials are used in propulsion and reentry components of advanced strategic systems. Failure mechanics and mechanical behavior are significantly affected by initial flaw and defect distributions which are strongly controlled by the processing the material has experienced. This research program will identify the macro and microstructural damage mechanisms and develop a physical model of the carbon-carbon as it is processed.

Through experimental observations and measurements determine the microstructural characteristics and thermal and mechanical properties of the filament and matrix phases as well as of the multidirectional composite. Actual properties will be measured as a function of processing. Extensive microstructural characterization will be conducted to isolate and determine damage mechanisms operative during processing. Crack propagation studies will be conducted in the scanning electron microscope to determine modes and sequences of constituent failures. Finally, a physically based in-process model will be developed and correlated with flaw and defect distributions observed in 3-D circumferentially woven carbon-carbon materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, MULTICOMPONENT OXIDE SYSTEMS FOR CORROSION PROTECTION

W.H. Steier, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF048800; AFOSR-77-3334)

AF function - Air Force systems, particularly aircraft, are subjected to a variety of corrosive environmental conditions during their operating lifetimes. To increase reliability and reduce operating costs, improved protective coatings must be developed to minimize corrosion damage. Deficiency - corrosion damage to high-dollar-value equipment costs the Air Force as estimated 250 million dollars per year. Objective - to use a unique approach to the problem of corrosion protection for aircraft aluminum surfaces and to develop and characterize new multicomponent oxide coatings using criteria based on a conceptual model. How work contributes - substantial cost savings to the Air Force will result from improved anticorrosion coatings.

Evaluate the corrosion properties of aluminum oxide/chromium oxide, develop techniques for deposition of multicomponent oxide films, characterize these films by Auger and XPS analysis and evaluate their corrosion resistance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, FRACTURE AND FATIGUE CHARACTERIZATION OF AIRCRAFT STRUCTURAL MATERIALS UNDER BIAXIAL LOADING

D.L. Jones, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DF045860; AFOSR-76-3099)

AF function - to contribute to a better understanding of fatigue and fracture processes for structural materials so that their life-cycle serviceability might be optimized. In this manner, Air Force flight vehicles can, ultimately, be much improved. Deficiency - a better understanding about flaws and their associated effects under biaxial loading will allow designers to consistently improve flight worthiness. Objective - this research program is given to the problem of understanding the effect of biaxial loads on cracked metal specimens. How work contributes - better knowledge about the behavior of structural materials under biaxial stress conditions should serve to improve Air Force flight systems and their components.

The primary emphasis of the analytical research effort will be to formulate the proper foundation for fracture mechanics applications under biaxial applied loads. The experimental portion will emphasize the determination of the effects of biaxial applied loads on the fracture toughness and on fatigue crack growth rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, SHF AIRCRAFT ANTENNA FOR SATCOM

C.A. Chuang, Harris Corp., Electrical Systems Division, *Melbourne, Florida* (DF905050; F19628-79-C-0173)

To design, fabricate and test a high power, multi-faced mounted antenna array that, in cooperation with a tent shaped radome structure, provides zenith-to-horizon coverage and offers high power capability. The array will be used in the airborne end of a satellite-to-aircraft communication system at 7-8 GHz.

The tent array geometry, 2 long sides and 2 short (front and back) sides lends itself to small, low protrusion arrays, significantly smaller than those now in use. Medium gain arrays of microstrip of slot elements can be formed to meet the coverage specifications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, AFATL STRUCTURAL INTEGRITY TECHNOLOGY STUDIES

W.W. Dyess, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF649000)

The objective of this program is to conduct theoretical and experimental investigations to advance the state of the art in analytic techniques for predicting stress and structural loads for the combination of aircraft and external stores.

Through load path studies, better methods of estimating the loads acting on various parts of the store will be obtained, thereby, showing how inertial and aerodynamic forces influence structural integrity, and in turn, store design. The aerodynamic forces acting on the store in both a free stream environment and external carriage on an aircraft will be obtained from the store-distributed airloads program. Models such as beams for which the structural characteristics are known will be used to research, via static loads tests, load path boundary conditions internal to a complex structure (wing, pylon, etc.). These efforts will allow for evaluation of the validity of using computerized models for structural analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0020, MOTION SYSTEM TESTING

G.A. Wyndle, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulation Concepts Lab., *Orlando, Florida* 32813 (DN994014)

Develop the necessary materials and program to provide the ability to perform (a) acceptance testing, (b) quality assurance and revalidation testing, (c) daily readiness testing and (d) diagnostic testing of synergistic cockpit motion hardware.

Develop the testing plan, award contract for software services, test software and hardware developed, field test the testing program and apparatus.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulation Concepts Lab.

4.0021, ANALYSIS OF COHERENT POLARIZATION DIVERSITY RADAR LIDAR FOR METEOROLOGICAL APPLICATIONS

J.I. Metcalf, Georgia Tech Research Inst., *Atlanta, Georgia* 30332 (DF582290; F19628-79-C-0076)

AF function - radar detection and identification of aerospace operational hazards. Deficiency - hydrometeor characteristics adversely affect the performance of many Air Force systems. Objective - perform a detailed systems analysis on the most suitable combination of coherent polarization diversity optical and/or microwave techniques for the remote determination of hydrometeor size distribution and phase. How development contributes - provides technique and system for remotely identifying weather phenomena affecting missile trajectories, communications links, and fire control radar paths.

The results of a previous study will be utilized to determine the effectiveness of various combinations of coherent polarization diversity radar and LIDAR systems in the remote sensing of the size distribution and phase of precipitation particles. A detailed analysis, including hardware performance tradeoffs and hydrometeor definition capabilities, will be performed on the radar/LIDAR system which offers the most promise in measuring these particle characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0022, LSI DESIGNS FOR ASYNCHRONOUS SEQUENTIAL CIRCUITS

G.K. Maki, University of Idaho, School of Engineering, Dept. of Electrical Engineering, *Moscow, Idaho* 83843 (ECS80-05349)

Asynchronous sequential circuits are useful in such applications as real-time controllers in automated control environments, e.g., flight controllers and nuclear and chemical process controllers, and interfaces for input/output digital systems. Classical switching theory approaches to asynchronous and fault tolerant designs are based on a set of parts and assumptions that do not apply well to Large-Scale Integrated (LSI) and Very Large-Scale Integrated (VLSI) circuits. This research draws upon prior work by the P.I., who developed a new algorithm and new design procedures, which look promising for LSI and VLSI circuits, and addresses the following two areas: (1) Design of reliable Asynchronous Sequential Circuits. This includes the design of fail-safe, fault-tolerant circuits and circuits

with built-in-tests for self testing, and automatic hardware re-try to protect against transient faults; (2) Design of Speed Independent circuits for fast asynchronous operation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0023, BALLISTICS OF MISSILES WITH CONSIDERATION OF JET PLUMES INTERFERENCE EFFECTS DURING LAUNCH AND FREE FLIGHT PHASES (ABBREV)

H.H. Korst, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DA0E9089; DAAG29 76 G0209)

To conduct a comprehensive research program dealing with aerodynamic interference problems encountered during various phases of in-tube propulsive burning and ballistic flight trajectory of rockets. This research is directly relevant to the problem of estimating jet plume effects on performance, stability and control of high acceleration rockets and missiles. Such problems have been identified as high priority advanced technology areas in the MICOM missile plan. In addition, it is relevant to the research activities at BRL in launch and transitional ballistics.

This program shall include theoretical analysis, computer program development, mayhematical modeling, and selected experimentation aimed at establishing the merits of analytical and modeling concepts for jet plume-launcher wall interference, blow-back at breach, muzzle blast, and jet plume-slipstream interference.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0024, BALLISTICS TECHNOLOGY-FLIGHT DYNAMICS - EXPLORATORY DEVELOPMENT TESTING - AERODYNAMICS

W.B. Sturek, U.S. Dept. of Defense, Army, Armament Research & Development Command, Launch & Flight Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4426)

This project covers exploratory development tests and applied research programs in the field of aerodynamics and flight mechanics which contribute to the rational design of projectiles, missiles, shell, and rockets. Significant studies undertaken involve the measuring of supersonic and transonic magnus force on non-conical boattails--the determining of supersonic magnus force on low drag ogive boattail models--the probing of the transonic boundary layers--the obtaining of total head pressure surveys of the boundary layer on yawed spinning models with boattails--and the performing of 3-D transonic inviscid flow calculations.

Exploratory development tests and applied research programs are conducted in closed circuit variable density, continuous flow transonic and supersonic wind tunnels as well as in free flight ranges. Theoretical analysis and numerical techniques are also used.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0025, TRANSIENT RADIATION EFFECTS IN DIELECTRICS (Z99QAYTA007-DNA)

P.S. Winokur, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0B5646)

Perform research, analysis, and testing to develop a better understanding of transient nuclear radiation effects on dielectric materials. The goal is to gain sufficient knowledge to accurately predict the response of materials and devices (integrated circuits, capacitors, cables) to nuclear radiation or to design these entities to assure proper operation in a radiation environment.

Determine the physical mechanisms of the permanent and transient radiation damage in organic and inorganic dielectric materials used in semiconductor devices, cables and capacitors. The charge generation, recombination, transport and trapping properties of the insulator will be determined following a short radiation pulse. The time dependence of the charge transport and the buildup of trapped charges in the bulk and at the insulator/metal or insulator/semiconductor interfaces will be examined. In the semiconductor devices mechanisms responsible for radiation induced interface states will also be investigated. Models describing the radiation response will be developed.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0026, LASER GYRO ERROR AND PERFORMANCE MODELING

J. Feldman, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DF053710; F49620-79-C-0001)

AF function - ringlasers are likely to play a significant role in future aircraft and missile navigation and control systems. Selection of the best instrument for a task requires reliable and comprehensive definitions of instrument performance. Such definition, when standardized, stimulates improvement of design and promotes economy without restricting choices. Opportunity - practical performance comparisons and efficient test methods are developed, by the early-collection and analysis of scientific data during R&D of various instrument types by an independent leading inertial systems laboratory. Objective - comprehensive ringlaser gyro error modeling, including physics, design and systems aspects, in particular, initiation of research of the signal properties of ringlasers to develop standard error and performance models and data formats, evaluation of the potential of various laser gyros for use as wide-band instruments (allowing short integration times at low sensitivity thresholds) which entails the description and measurement of laser gyro behavior over a wide frequency range, and stimulation of improved designs. How work contributes - work will provide the community of users with tools required for generally acceptable characterization of instruments as basis for efficient testing and optimum application, it will be closely supportive of and complementary to the development of standard, universally usable test programs, which are sponsored already under Air Force and Navy contracts, it will consider the whole class of optical rotation sensors and render the background for objective selections and guidance for improvements.

Emphasis will be put on the evaluation of the stochastic characteristics of the output signal over the full frequency range spanning the high frequency concerns for systems and updating of algorithms, to the low frequency concerns during continuous operating periods or between periodic calibration. Techniques for modeling of the statistical characteristics of output data will be analyzed and performance coefficient sets will be established for the three performance parameters of scale factor, bias and bandwidth, that will permit the fair comparative rating of the four classes of ringlasers -two wave and four wave active ringlasers, passive ring optical resonators and interferometers. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, HOT ELECTRON INJECTION INTO GaAs AND RELATED MATERIALS - 14813-P

D. Adler, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0F9138; DAAG29-78-G-0035)

To understand and to describe theoretically by means of band models, the electronic transport between amorphous and crystalline materials of technological interest. Relevance: The research has potential relevance to the field of high speed microwave and optoelectronic devices. Injection of hot electrons directly into subsidiary conduction band minima of a technologically important material from a bistable emitter has potential for improving the efficiency of transferred electron devices.

The effects of hot electron injection from the on state of threshold-type chalcogenide glasses into III-V semiconductors will be studied. Wide band gap glasses will be used to inject

electrons directly into subsidiary minima of the conduction bands in both N and P type crystalline semiconductors. I-V characteristics of the heterojunctions will be measured with and without presence of light. Band diagrams will be derived and tested. Electroluminescence and photoluminescence properties of the heterojunctions will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0028, HIGH RESOLUTION IMAGING OF SPACE OBJECTS

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AF function - for the surveillance of spacecraft in earth orbit, this research offers the possibility of obtaining images of space objects, observed through the Earth's turbulent atmosphere, with resolution not previously possible. Deficiency - imagery of space objects has not been obtainable by the various interferometric techniques for obtaining autocorrelations or the Fourier transform modulus of the object. Objective - to recover high resolution imagery of space objects viewed through the turbulent atmosphere. Contribution -a new computer algorithm will be developed to produce high resolution imagery from the same interferometer data from which it only has been possible to obtain autocorrelations or reconstructions of objects that are centrally symmetric or have a nearby point source.

Field data from existing speckle interferometer systems of physical astromonical objects will be acquired and processed to assess processing needs and requirements. The iterative input - output technique to reconstruct an object from the modulus of its Fourier transform will be improved to operate in near real-time on imperfect real-world data. The uniqueness of the solutions will be determined under various conditions of the data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, REPAIR AND RESTORATION OF PAVED SURFACES (REREPS)

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To develop improved repair and restoration systems for paved surfaces (REREPS) that will be responsive to both the variations in damage levels from aggressor attacks and U.S. forces operational requirements. To develop an airborne capability of runway repair within 8 hours using air-delivered materials.

The study approach will consist of a five-phase, overlapping, multi-disciplined research effort--phase I, current updating of strike threat analysis and damage assessment; phase II, evaluate potential REREPS materials; phase III, evaluate potential REREPS procedures; phase IV, develop a rapid repair procedure applicable for airborne operation; phase V, prepare a rereps field training document. Information developed will be incorporated into laboratory documentation and a future TM on REREPS.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

4.0030, THREE-DIMENSIONAL TRANSONIC FLOW ANALYSIS

G.E. Chmielewski, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF043730; F44620-76-C-0096)

AF function - advanced aerospace vehicles. Opportunity - improved flowfield prediction methods in the transonic regime. Objective -develop a computational program which will permit calculation of steady, inviscid transonic flowfields around complex three-dimensional bodies. How contributes - development of this technique will help reduce present requirement for extensive and expensive wind tunnel testing.

A method will be developed for the solution of the transonic full potential equation using the finite difference analog to the governing differential equation. A rectangular computational grid derived from either Cartesian or skewed coordinates will be used and complicated global mappings will be avoided. The exact surface boundary conditions will be enforced on embedded curved surfaces using interpolation among surface-adjacent points.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, RTG SAFETY STRUCTURAL ANALYSIS

C. Dower, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF183230)

Within the context of nuclear safety, this project is to investigate the response of aerospace nuclear systems and related systems, such as those of the respective launch vehicle and spacecraft to impulsively applied loads. It is in support of AFR 122-15 AFWL responsibilities for technical support to AF/IGD(SNS).

Performance of a complete literature search of relevant work to obtain data from which a detailed study program can be defined. Initial preliminary calculations to indicate feasibility of approach will provide the interagency nuclear safety review panel (INSREP) support applicable to the LES 8/9 and Viking launches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0032, SPACE ELECTRIC POWER SUPPLY (SPAR)

D. Buden, University of California, Central Office, U.S. Dept. of Energy Los Alamos Scientific Lab., *P.O. Box 1663, Los Alamos, New Mexico* 87545 (D434; W-7405-ENG-36)

The objective of the program is to establish the technology base for a high-temperature, compact nuclear-electric power supply for use in space. The approach to meet this objective is to design, fabricate, and test the principal components that comprise the power plant in sufficient quantities to provide a high confidence that a power plant can be operated with a high degree of success. Analytical effort is currently being concentrated in the area of power plant design and system safety, while experimental effort is being concentrated on core heat pipes, reactor assembly and heat transfer, in-pile radiation testing of fuel, thermoelectric modules, and radiator heat pipes. Test facilities are being established for long-term component verification testing.

SUPPORTED BY U.S. Dept. of Energy, Office of Policy & Evaluation, Office of Nuclear Energy

4.0033, COMMUNICATIONS-EXPERIMENTAL AND THEORETICAL STUDY OF WAVES AND IRREGULARITIES IN THE EARTH'S IONOSPHERE

M.C. Kelley, Cornell University, Ithaca Campus, School of Electrical Engineering, Dept. of Electrical Engineering, *Ithaca, New York* 14850 (DN575348; N00014-75-C-0780)

Ionospheric irregularities are responsible for degraded performance of naval communications and navigation signals propagating through the ionosphere. The purpose of this research is to determine the causes of these irregularities and their effects on existing or planned naval electromagnetic systems, and to study the natural processes responsible for generation of ELF and VLF waves in the Earth's magnetosphere and ionosphere.

Theoretical and experimental research on plasma instabilities in the ionosphere and magnetosphere is performed, together with analysis of data including vector electric field data from the S3-3 satellite, rocket and satellite data on plasma density irregularities and electric fields, and radio scintillation measurements. The effects of various instabilities on transionospheric radio propagation is modelled.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, AIRBORNE VELOCITY SENSOR TECHNOLOGY

H.W. Wimmer, General Electric Co., Aerospace Electronic Systems Division, *French Rd., Utica, New York* 13502 (DN781338; N62269-76-C-0306)

The objective of this task is to develop a full function correlation velocity sensor. This work supports work unit ZN101, agency accession no. DN081116.

A development model velocity sensor will be built to measure two dimensions of horizontal velocity, including hover, by the correlation technique. The sensor will be designed to operate over all terrains and water surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0035, INVESTIGATION OF QUANTUM EFFECTS IN HETEROSTRUCTURES - 15229-P

L. Esaki, International Business Machines Corp., *P.O. Box 218, Yorktown Heights, New York* 10598 (DA0F9199; DAAG29-78-C-0007)

To explore new features of semiconductor heterostructures. Relevance: Research in this area has the potential of developing ultra high speed thin film devices utilizing quantum mechanical effects on a physical scale which has not yet been obtainable. The eventual development of such devices is directly related to on-going programs in target acquisition, ranging, and guidance, and will provide a new class of microwave device, possessing higher frequency response than conventional components, which will be of particular interest for millimeter applications.

Semiconductor superlattices will be investigated in which conduction band minima and valence band maxima of adjacent layers are very close together in energy. Alloys to be studied will include InAs-GaSb. Characterization will include scanning high energy electron diffraction, Auger electron spectroscopy and profiling by argon sputter etching. Electronic and optical properties will be determined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0036, ANALYSIS OF LUBRICANT FILMS IN BEARINGS UNDER INCIPIENT FAILURE CONDITIONS BY INFRARED SPECTROSCOPY

J.L. Lauer, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engin Aeronautical Engin & Mechanics, *110 8th St., Troy, New York* 12181 (DF051060; AFOSR-78-3473)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - lubricants continue to fail at elevated temperatures due to complex chemical and physical interactions of the bulk lubricant with its environment and with both static and moving metal surfaces. Objective - understand the bulk and boundary layer chemical - physical properties of lubricants to determine causes of bearing failure. How work contributes - information gained from this research will be used to formulate improved lubricants for AF application that can withstand conditions of extremely high temperatures, pressures and shear rates.

Infrared emission spectra will be obtained through a window in an operating sliding bearing lubricated by a number of standard fluids. A variety of realistic operating conditions will be probed. The spectra will be analyzed for chemical and physical changes in the fluids (e.g., decompositions, glass transitions), fluid film and metal surface temperatures, and molecular alignment by polarization techniques. Conditions leading to bearing failure will be probed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0037, INTERDISCIPLINARY COLLABORATION IN TRIBOLOGY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0038, DEVELOPMENT OF HIGH-G AUGMENTATION DEVICES

G.J. Kron, Singer Co., *Binghamton, New York* 13902 (DF228250; F33615-77-C-0055)

To design prototype high-G augmentation devices to enhance the G-cue environment of future simulators. The devices will load the pilot's limbs, head and shoulders to augment the simulation of high-G effects.

The approach is to award a 9-month study contract for the design of G-cuing devices. Prototype devices (hardware and software) will be designed to apply appropriate forces effectively and safely. The contractor will investigate such techniques and devices as straps, active should harness, active helmet, lower and upper body negative pressure, and a sound system for aural cuing. After these devices have been designed a separate contract for building the devices will be awarded.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0039, STUDIES IN RADIATION HEAT TRANSFER

R.D. Cess, State University of New York, Stony Brook Campus, School of Engineering & Applied Sciences, Dept. of Mechanical Engineering, *Stony Brook, New York* 11794 (CME80-12954)

The research program is composed of two areas. The first involves spectroscopic identification of planetary cloud and haze compositions. Here we form laboratory frost layers under a variety of conditions, and then compare their spectra with ground-based and spacecraft spectra of planetary objects. A specific example is the recent identification of solid sulfur dioxide within the atmosphere of the Jovian moon Io. In this investigation we show that a spectral feature observed by the Voyager I spacecraft is consistent with solid sulfur dioxide formed at a temperature below 100K. The second area of research involves modeling the climatic effect of atmospheric aerosols. For example, we are presently constructing a radiative transfer model for use in climatic impact studies of volcanic aerosol.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Civil & Mechanical Engineering

4.0040, LIFE CYCLE COST STUDY

J. Klion, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF736880)

To investigate means through which the life cycle costs of Air Force electronic equipments and systems can be evaluated, optimized and predicted.

Continual survey and analysis of appropriate models, documentation, policies with regard to life cycle cost in general. Efforts relative to the development of level of repair synthesis (determining the LRU complement, mix, complexity level, size, cost with attendant reliability and maintainability characteristics) which will optimize life cycle cost. Determination of the impact of reliability, maintainability and test equipment on acquisition and support/logistics costs. Determination of cost differences in hardware as a function of level of repair and performance characteristics. Studies and analyses of warranty effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0041, MILLIMETER WAVE ATTENUATION EMISSION STUDIES

U.H. Lammers, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF905740)

Millimeter wave propagation is adversely affected by tropospheric gases and precipitation, which cause path attenuation, depolarization, and large-bandwidth incoherence. It is the objective of this effort to determine the effect of the troposphere on long-range communication and data links along slant paths through the medium, such as between aircraft or satellites and ground. Recent evidence of signal depolarization due to cirrus cloud requires further investigation.

Beacon transmitters at 19 and 28 GHz have been launched onboard three COMSTAR domestic communication satellites to permit propagation studies on high-angle satellite paths through the Earth's atmosphere. A dual frequency satellite receiver is under development, which will allow statistical measurements of signal levels, coherence and depolarization. This receiver will be operated in connection with the Prospect Hill 18 ft. antenna. Simultaneous radio and surface meteorological data will be obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0042, CLOSE COUPLED STABILIZATION CLUSTER TEST DEMONSTRATION SYSTEM

Unknown, Stencel Aero Engineering Corp., *Asheville, North Carolina* (DA0H4393; DAAK60 78 C 0092)

To determine technical feasibility of the use of a closely coupled cluster of small flat circular parachutes for improving platform pitch stability during the high speed descent stage of a high altitude platform airdrop system. If successful, this concept will be simple and less complex than other alternatives currently under investigation.

To procure a test demonstration system for actual airdrop and observation of results. A test demonstration is needed because questions relating to reliable deployment and inflation of the small cluster operating in the near wake of the airdrop cargo can only be resolved in this fashion.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0043, EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS OF CHARACTERISTICS OF STAND ALONE SOLAR PHOTOVOLTAIC ENERGY SYSTEMS AND COMPONENTS

G.C. Chang, Cleveland State University, School of Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NCC 3-16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0044, HIGH TEMPERATURE ELECTRONICS

R. Anderson, General Electric Co., Aircraft Group, *Evendale, Ohio* (DN980427; N00173-79-C-0010)

To investigate device and integrated circuit performance for direct utilization in Navy aircraft engine control functions up to 300 deg C. The program will integrate existing high temperature performance data with that obtained from representative members of the full family of devices and circuits required for engine control at 300 deg C. Reliability and performance limiting factors are to be determined. The full program is to include all promising high temperature semiconducting materials.

This effort is considered to be integral to a long range NAVAIR program on improved devices and related technology pertaining to Navy aircraft requirements. It is expected that initial phases will be expanded as progress and more advanced requirements warrant. Initially, the program will investigate silicon devices and integrated circuits for the high temperature application performance and reliability factors will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0045, SIMULATION AND MEASUREMENT TECHNIQUES FOR RECONNAISSANCE SENSOR EVALUATION

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To develop simulation, measurement and motion analysis techniques specifically for design integrity and performance evaluations of advanced reconnaissance sensors. Also to apply techniques for automated readout and data reduction to expedite the evaluation of sensors. The intent will be a documented body of knowledge concerning measurement and computational techniques applicable to performance evaluation, and means to more faithfully simulate actual operational situations.

Contractor has been provided access to former gun range at Area B, WPAFB and the accelerated runway for ground tests, up to 2000 feet range. Appropriate resolution targets and other photographic subjects have been acquired. The first major subtask has been to investigate the uses and limitations of a polar nephelometer to measure atmospheric scatter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0046, INSTRUMENTATION, FACILITIES AND TECHNIQUES FOR COLLECTING DYNAMICS AND LOADS DATA ON AIR FORCE WEAPON SYSTEMS

D.L. Banaszak, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140280)

The broad problem facing the Air Force is to decrease life cycle costs of current and future aerospace weapon systems. Knowledge of the actual and expected flight and dynamic loads environments, is an essential requirement for the reduction of costs of Air Force weapon systems. The objective of this effort is to develop, and improve sensors, instrumentation systems, facilities and techniques that are required for the collection and analysis of flight and dynamic loads data in an inexpensive, reliable and expeditious manner. This effort provides the equipment and facilities needed to collect and analyze the data required to validly define the loads environment of Air Force weapon systems. The data will provide the neccessities for identification, prediction, prevention and control of vibration, structural, dynamic, flutter and acoustical problem areas.

Evaluations, investigations, configurations, procurements, environmental tests and flight tests of various types of flight data acquisition systems, sensors and components will be performed to ensure compliance with accuracy, life, flight-worthiness, maintenance, size, performance, weight, reliability and safety requirements of loads data collection systems. Particular items of concern include multivoltage power supplies, integration circuits to increase dynamic range of dynamics data acquisition packages, detailed investigations of PCM techniques for dynamics data acquisition and investigations of magnetic bubble memories for use as a replacement for magnetic tape recorders. Future data acquisition requirements will be determined and appropriate instrumentation will be developed and procured. Improvement of facilities include technical evaluations of contractors reports, procurement of state-of-the-art shaker and shock test systems, an evaluation of a study contract let by ASD engineering to determine manning usage of existing facilities, and maintaining mobile facilities (vans). New vibration testing and analysis techniques will be studied in-house. Studies will include the purchasing or writing of required analysis computer in-house programs and conducting experimental programs to check current and proposed ground vibration techniques. Reports will be prepared presenting results and conclusions of the experimental programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0047, DEVELOPMENT OF A SPECTRO-CHEMICAL DIAGNOSTIC TECHNIQUE TO MEASURE GAS STAGNATION TEMPERATURE ON MISSILE NOSE TIP IN RENT FACILITY

H. Lee, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF130160)

Performance of high speed ballistic missiles has outpaced the capability of ground test facilities to simulate the severe conditions encountered during re-entry. The technical lag exists primarily in the area of thermal measurement instrumentation. The objective of this effort is to demonstrate the feasibility of new spectroscopic and electronics technology for measuring local

gas temperature, and provide a useable wind tunnel instrumentation system. The temperature measurements that will be obtained are germane to both ground and realistic operational testing.

A proportional control system will be used to control the pressure in the exiting dome regulating valves. Added controller dynamics will provide accurate following of desired heater pressure ramp rates. Both the heater and shroud regulators will be made to follow a single generated ramp signal with provision for manual adjustment to obtain the mass flows required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0048, STRUCTURAL AND KINETIC PROPERTIES OF GRAPHITE INTERCALATION COMPOUNDS

D.L. Chung, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF051500; AFOSR-78-3536)

AF function - airborne system utilized for command, control, communications, reconnaissaince and surveillance depend heavily upon interconnected electronic components. Opportunity - increased efficiency of these systems can be expected from the use of less expensive lighter materials such as intercalated graphite compounds for electrical conductors. Intercalated graphite compounds, weighing about one fourth of that of copper, offer potential conductivities greater than that of copper. Objective - this research seeks a quantitative understanding of the structural and kinetic mechanisms and properties of graphite intercalation compounds. How work contributes - this work should contribute to the control of processes for the formation of desired graphite intercalation compounds that could replace copper as the dominant electrical conductor of airborne systems.

Experimental and theoretical work will be carried out to investigate the kinetics of intercalation, surface profilometry, electron microprobe measurement, B.E.T. Surface area measurement, and quantitative metallography. In addition, the microstructural and crystal structural effects of these processes will be characterized by using scanning transmission electron microscopy and x-ray diffraction respectively.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, NON-CORRODING AIRCRAFT ELECTRICAL CONNECTOR HOUSING

J.T. Purpura, U.S. Dept. of Defense, Navy, Naval Air Development Center, *Warminster, Pennsylvania* 18974 (DN181108)

The purpose is to determine the feasibility of developng a non-corroding electrical connector housing for use in Navy aircraft.

Reinforced polymeric materials offer promise as candidates for electrical connector housings. Candidate materials will be subjected to critical appraisal with regard to the specific requirements of aircraft electrical connector housings. Requisite material tests will be conducted on appropriate candidates. Connector housing will be fabricated from the more promising candidate materials. Mechanical and environmental tests will be conducted on fabricated components to determine their suitability in Navy aircraft electrical systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Surface Weapons Center

4.0050, EVOKED CRITICAL RESPONSES AS AN INDICATOR OF G TOLERANCE

M.M. Cohen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881699)

To determine whether evoked cortical responses to visual stimuli can provide an objective, quantitative, reliable, and non invasive indicator of human tolerance to G3 acceleration loads.

Changes of visual function such as decreased visual sensitivity, dimming of the visual field, peripheral light loss PLL and central light loss CLL have been shown to preceed the loss of consciousness LOC that can result when human subjects are exposed to excessive Gz acceleration loads that can be encountered in air combat. Both the visual changes and the LOC are due to inadequate blood supply to the eyes and brain resulting from acceleration produced hydrostatic pressures in excess of cardiovascular capacities. Although Doppler flow techniques can provide objective indications of flow velocity, these techniques are sensitive to straining maneuvers on the part of the subject, and the resulting artifacts can make the interpretation of Doppler flow signals extremely difficult when the subject is not completely relaxed. In contrast, evoked cortical responses should reflect the integrity of the visual system, irrespective of straining maneuvers. In the proposed experiments. PLL, CLL, Doppler flow measures, and evoked cortical responses will be recorded and studied while volunteer human subjects are exposed to increased Gz acceleration loads, both when the subjects are relaxed and when they perform L1 and M1 straining maneuvers. Changes in the evoked cortical esponses will be correlated with the other physiological and behavioral parameters, are the efficacy of evoked cortical responses as an indicator of Gz tolerance will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0051, ADVANCED FOCAL PLANE ARRAY TECHNOLOGY

S.B. Campana, U.S. Dept. of Defense, Navy, Naval Air Development Center, Sensors & Avionics Tech Directorate, *Warminster, Pennsylvania* 18974 (DN333043)

To develop visible and infrared imaging devices with increased performance (sensitivity and/or resolution), improved visibility and decreased size, weight, and power consumption.

Provide technical support to the NAVELEX focal plane array technology program in the form of analysis, establishment of specifications, technical review of contracted efforts, and test and evaluation of delivered devices.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronics System Command

4.0052, AFATL LV FLOW FIELD STUDY

F.L. Heltsley, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421127; F40600-77-C-0003)

The objective is to evaluate a three component LV system for velocity measurements in flow fields of selected wing/pylon/store configuratiοna.

An existing semispan wing mount was modified to provide both 0 and 2 deg angle of attack. Pylons of two different shapes will be fabricated. A single component LV will be combined with a dual component LV to provide three component measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0053, AIRCRAFT/STORE TRANSONIC AERODYNAMIC INTERFERENCE

S.N. Chaudhuri, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DF644460; F08635-80-C-0088)

Air Force function - store airloads and separation analyses. Deficiency - analytical prediction of store aerodynamic forces in-carriage under transonic conditions. Objective - to increase the base of fundamental knowledge in transonic aerodynamics as related to the external carriage of conventional munitions of USAF aircraft which will lead to development of a theoretical technique to predict the aerodynamic forces acting on external stores at transonic speeds. How work contributes - there is currently no theoretical technique available which can handle the problems of nonlinear flow and shock interaction which occur during transonic carriage of external stores. The aerodynamic forces acting on external stores are required for prediction of structural loads and separation trajectories. The technique will considerably reduce the costly wind tunnel and flight testing presently required to determine aircraft/store aerodynamic compatibility.

The principal investigator shall conduct research and engineering programs to develop new techniques for predicting weapon release trajectories in the transonic regime. The technique shall consider the first order mutual interference effects among the wing, store, pylon, rack, fuselage, and additional stores remaining on the aircraft. The technical approach to be employed will solve the basic Navier-Stokes equations in closed form by using quasi-iterative process. Basic math models, starting with wing alone, will be solved and the results compared with wind tunnel test data. If successful, the solution will be expanded to include store, store/pylon, and eventually multiple stores.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0054, PHOTO INTERPRETATION LOGIC (DA0R8000)
J.N. Rinker, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (DA0G2454)

To determine those steps of the procedure for manual analysis of aerial photography that lend themselves to digital, automatic, or interactive computer techniques.

A detailed examination is being made of the deductive/inductive photo analysis procedure developed and used by present and former members of the CRS staff. This involves the identification and evaluation of specific pattern elements, referred to as indicators, coupled to a documentation and evaluation of the logic involved in deriving information directly, indirectly, or inferentially about terrain identities, composition, and properties. In conjunction with other elements of ETL, each step of the logic sequence will be tested in relation to the applicability of automatic, digital, or interactive techniques.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

4.0055, NAVY VEHICLE DESIGN AND CONSTRUCTION - SHOCK/BOUNDARY-LAYER INTERACTIONS
G.R. Inger, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace & Ocean Engineering, *Blacksburg, Virginia* 24061 (DN075482; N00014-80-C-0470)

There are a variety of applications in the aerodynamic community which utilize jet blowing tangent to a wall surface to produce control of attached turbulent boundary layers. For incompressible flows the fluid dynamic phenomena associated with this type of flow are well understood and predictable. However, when compressibility effects become important, additional complications arise. Especially, the presence of shock waves impinging on these wall jet flows can cause drastic changes in the performance of a particular concept. It is the objective of this research to investigate the turbulent boundary layer/shock interactions in which the boundary layer is dominated by a tangential wall jet.

A successful transonic boundary layer/shock interaction theory will be modified to be applicable to tangential wall jet dominated flows. The new theory will be evaluated and applied to practical wall jet cases.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0056, AUTOMATED MOTOR SKILLS TRAINING OPTIMIZED FOR INDIVIDUAL DIFFERENCES
R.C. Williges, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Industrial Engineering & Operations Research, *Blacksburg, Virginia* 24061 (DF046460; AFOSR-77-3161)

AF function - this research supports all af flight and technical training programs, especially those in which computer based instructional systems are used, such as flight simulation. Deficiency -many factors about how a student learns are still unknown, and instructional systems which are designed for complicated flight and technical training are less efficient because of this. One major factor is individual differences in learning style, experience, and learning rates. If these individual differences could be reliably detected among learners and attended to by an adaptive, individualized instructional system, a more efficient training system might result. Objective - the objective of this research program is to investigate procedures for providing computer-adaptive motor skills training which is optimized for student individual differences. How research contributes - this research will produce models of adaptive instructional systems which will accomodate individual learner differences. The relative efficiency of these systems over conventional systems will be determined as part of the research.

A two-pronged research program plan is proposed to investigate several of the fundamental research issues underlying the use of automated procedures in motor skills training. These issues deal with individual differences in motor skills acquisition and the investigation of parameters of adaptive training systems. Experimental investigation of these two issues is needed before direct applications and optimizations of automated motor skills training procedures can be made to Air Force operational synthetic flying training devices. 1) the comparison of previously developed regression assignment models and automatic linear optimization procedures to a learner controlled model which allows the trainee to adapt to computerized pursuit tracking task manually and 2) the integration of the experiments of the past four years on this research effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0057, EVALUATION OF EXPLOSAFE
A. Szego, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF460700; F33615-77-C-3115)

Evaluation of an advanced explosion suppression material called 'EXPLOSAFE' for use in aircraft fuel tanks.

The program is structured into two major phases. Phase I consists of initial material qualification testing by the contractor and determining the feasibility of installing EXPLOSAFE in aircraft fuel tanks. Phase II consists of the USAF evaluating the explosion suppression performance of EXPLOSAFE at various densities and joint AF/Army evaluation against ballistic threats.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, POLAR ICE INVENTORY
H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeological Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-2361)

Recently produced topographic contour maps of single stereophotogrammetric models in the north and south polar regions of Mars have allowed estimates to be made of the thickness and volume of each residual polar cap. Both ice caps are estimated to be about 2.2 km thick. Based on this figure the north polar cap contains more than 2 million cubic kilometers of water ice and particulate material, dust or clay particles; volume of the carbon dioxide ice and dust or clay particles in the south polar cap is 400,000 cubic kilometers. These preliminary figures will be updated when additional profiling and mapping of the polar caps provide more complete data. Additional volumes of ice are contained as interstitial cementing material in the extensive dune and layered deposits that occur beneath and to the south of the permanent ice.

Horizontal dark and light layers can also be seen in the deposits which fringe the permanent continuous ice cap and which underlie it. Absence of craters larger than a few kilometers in diameter attests to the relative youthfulness of these deposits. The layers have probably been preserved by binding of discrete dust particles in each layer by interstitial ice. Continuity of the layers indicates a lack of predominantly snow layers intercalated between dust layers; snow and ice layers, when exposed in this region, are complexly eroded by wind action and sublimation so that dust layers deposited on them would be discontinuous. Spiral patterns etched into the residual ice record the anticoriolis flow directions of wind moving downward and outward from the pole; farther south the patterns recurve into the corio-

lis direction. Similar patterns are visible in satellite pictures of the Earth's polar cloud patterns. Dunes may be composed of medium-sand size grains composed of silt and clay, cemented by ice or water. Similar dunes of composite grains have been observed in Nevada playas.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, VARIATION WITH HEIGHT OF SMALL-SCALE SOLAR MAGNETIC AND VELOCITY FIELDS

R.C. Smithson, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (DF248970; F19628-78-C-0087)

AF function - communications, surveillance, detection, tracking. deficiency - inadequate warnings of sun-induced disruptions. Objective - measure the small-scale vector magnetic and velocity fields in the solar atmosphere as a function of height. How research contributes - it is widely accepted that the interaction of velocity and magnetic fields on the sun provides the energy and trigger for solar flares. Knowledge of the distribution of these parameters is necessary background information for understanding the physics of flares and their geophysical effects.

A universal filter capable of recording all Stokes parameters will be used at the Sacramento Peak Observatory tower telescope to probe the solar atmosphere by using different-strength spectral lines. The resulting three-dimensional values of vector magnetic and velocity fields will be analyzed to determine their time-dependent behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, NAVY ENVIRONMENT - MARGINAL ICE ZONE

B. Andersen, Science Applications Inc., *1200 Prospect St., La Jolla, California* 92037 (DN975462; N00014-80-C-0368)

The objective of this task is to participate in a field program to investigate the Pacific Marginal Ice Zone in support of the Navy's continuing Submarine Arctic Warfare Program.

The principal investigator will collect oceanographic data aboard the USCGC Polar Star. Cruise is funded by NOSC(ASL) and will have active participation by that laboratory as well as the Navy Postgraduate School.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0004, MEASUREMENT AND ANALYSIS TECHNIQUES FOR MANAGEMENT PLANNING

E.L. Amidon, U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Forest & Range Experiment Station, *P.O. Box 245, Berkeley, California* 94701 (0000088; PSW-1301)

OBJECTIVE: Devise systems for providing forest managers with static inventory and dynamic biological response information needed for decision-making. Emphasis is placed on the mensurational problems associated with estimating wood product growth and yield.

APPROACH: Full use will be made of photogrammetry and associated scanning, digitizing, and computing techniques to determine the location of management problems and opportunities. Techniques for making stand-growth projections will be developed starting with tree-growth models. Techniques will be developed to provide advanced inventory estimating systems such as multi-stage probability sampling and the combined use of remote sensing and modern field measuring techniques.

PROGRESS: Research on the prediction of the growth of young trees in the mixed conifer type of the Sierra Nevada of California was extended from the Eldorado to the Sierra N.F. Data from the first field season showed, that for an individual tree growth prediction model, two increment cores are better than one. This year's second-field season's data, when combined with the first, will provide sound estimates of tree form and other basic characteristics for several species. The Wildland Resource Information System (WRIS) previously developed has been accepted for use on all National Forests until at least 1983. It will be served by a preprocessing system to provide a centralized map scanning service for national use. The subsystem will be comprised of a drum raster scanner and a microprocessor in order to digitize a resource map in minutes.

SUPPORTED BY U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Forest & Range Experiment Station

5.0005, MAPPING TECHNIQUES FOR ALTERED AREAS

R.P. Ashley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9320-72587)

STATE TO WHICH PROJECT PERTAINS: Nevada.

The primary objective is to test the utility of a hand-held spectroradiometer for field mapping of alteration zones in both previously mapped and unmapped areas in the vicinity of Goldfield, Nevada, in cooperation with Caltech - JPL.

A second objective is to begin processing and analysis of multispectral aircraft scanner data for the same area, if new data are available by April-May.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, QUANTITATIVE MORPHOLOGY OF VOLCANOES

R.J. Pike, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02355)

Quantitative comparisons of Martian volcanoes with terrestrial edifices whose mode of origin is known are the immediate goals of the proposed research. Various aspects of Martian crustal properties, magmatic and volcanic processes, and geologic history ultimately will be interpreted from the resulting correlations or the absence of them. Other products will include a refined classification of central volcanoes on the terrestrial planets and improvements upon current sets of data that characterize different classes of volcanoes. The research is an integrated, long-term, program of work on planetary volcanic landforms, with current emphasis on Mars, wherein a systematic, quantitative approach is applied to the interpretation of process from landform morphology. Topographic measurements for 15 large Martian volcanoes will be completed from photogrammetric reduction of Viking Orbiter images. While these data are being prepared, information on three of the most likely classes of candidate analogs on Earth --non-tholeiitic lava shields, tablemountains, and maars -- will be reviewed, updated, and improved. Multivariate comparison of the different classes of volcanoes may be revised.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0007, NAVY ENVIRONMENT - MERGING SATELLITE AND CONVENTIONAL OCEANOGRAPHIC DATA

R.L. Bernstein, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (DN975254; N00014-80-C-0440)

A series of academic and tactical studies are to take place in the Pacific Ocean in waters contiguous to the West Coast of the United States. A number of these investigations will be directly or indirectly in support of Pacific Fleet activities. Those activities, particularly ASW operations, need current and forecast knowledge of surface and subsurface thermal conditions, ocean waves, surface winds, and other ocean features over broad ocean areas of their operations. These mesoscale areas can be scanned in real-time with subsequent detailed interpretation of DMSP and NOAA satellite imagery. Near simultaneous measurements of physical oceanographic parameters are essential in the validation of ground-truth interpretations of the imagery.

Remotely sensed sea surface data from satellites and aircraft will be analyzed in conjunction with in-situ ocean thermal information. These field experiments will support the basis of design

criteria for satellite input to oceanographic research and subsequent fleet ocean forecasts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0008, REMOTE WAVE AND CURRENT SENSING
D.E. Barrick, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (DN975840; N00014-79-F-0056)

Contractor will obtain measured data on wind-fields and the fields of surface currents from an area of approximately 5000-8000 km2 in the German Bight during the International Marsen Program in summer/fall, and evaluate them in order to derive the mutual relationships between these fields as they exist during storm events. This knowledge is needed to derive capabilities to predict oceanographic information of interest to the Navy and Marine Corps from the result of meteorological forecasts in much greater detail than now available and to improve the capability to remotely sense the distribution of waves and surface currents over a large area of the sea.

Contractor will install two special radar transmitters/receivers developed in his laboratory, one on the island of Helgoland, the other one at the coast of Schleswig-Holstein, near St. Peter-ording, calibrate them and keep them ready for operation as soon as suitable storm events are announced; he will then take measurements for about half an hour each hour for a total of up to 96 hours. Between events, data processing will begin which is to be continued after the experiment as specified in a follow-on government order to be decided upon and negotiated at a later time. The expansion to be granted by ONR and augmented by a larger amount from other sources is to provide the funds for a third station which will improve accuracy and reliability of the results and expand the area covered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0009, ATLANTIC AND GULF STRUCTURES AND MOTIONS
D.V. Hansen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (83330111)

PROJECT OBJECTIVE: To increase knowledge and understanding of the kinematics and dynamics of current in selected deep and coastal oceanic regions as required for descriptive and predictive marine service of NOAA.

CURRENT YEAR PLAN: Research will continue on deep ocean circulation processes. Work will focus on historic and recently collected data analysis to determine large scale circulation patterns in the North Atlantic, Gulf of Mexico, Tropical Pacific, and the Western Indian Ocean. Plans are being developed and preparation initiated for research into the role of the oceans in global heat flux and the effects of large scale ocean thermal anomalies on atmospheric circulation.

PROGRESS REPORT: Major field efforts were undertaken and successfuly completed during SOP's I and II of the Global Weather Experiment in the Tropical Atlantic and Western Indian Ocean. New results were published on large scale current structures in the North Atlantic and on possible thermal feed backs between the oceanic heat transport and the atmospheric stress field. Large scale circulation patterns in the Tropical Pacific continue to be studied with satellite tracked drifting buoys.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0010, MINERAL AND ROCK SPECTROSCOPY
G.R. Hunt, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-01864)

Project objectives are to: a) Record and interpret visible and near-infrared spectra of selected minerals, rocks, soils, and vegetation to determine and explain their characterizing features. b) Extend this study into the ultraviolet range. c) Based on the results of the above studies to investigate the fluorescence spectra where appropriate and to apply the results to FLD studies. d) Continue rock spectral emission studies to determine effects of sample condition and environmental parameters. e) Complete field portable spectrometer and use at selected sites. f) Complete field testing and use the aircraft scanner to record near infrared data from selected sites.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, REMOTE SENSING STUDIES OF THE SAN JUAN BASIN REGION
D.H. Knepper, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02647)

STATES TO WHICH PROJECT PERTAINS: New Mexico, Colorado, Arizona, Utah.

Statistical analysis and geologic interpretation of linear feature data mapped from LANDSAT images will be conducted with the goal of defining major tectonic elements of the San Juan Basin Region. A map showing the distribution of limonite at the surface will be prepared for the region, and a study will be made to attempt to isolate anomalous limonite occurrences.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0012, STRATOSPHERIC MOLECULAR SPECTRA PARAMETER STUDY
A. Goldman, University of Denver, Graduate School, *2115 S. University Blvd., Denver, Colorado* 80210 (NAS 5-26364)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0013, NAVY ENVIRONMENT - COMMITTEE ON GEODESY - NAS
H. Orlin, National Academy of Sciences, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20037 (DN675178; N00014-76-C-0411)

A detailed understanding of the Earth's geoid and gravity field is vital to Navy operations such as FBM launch and targeting calculations and to precise navigational control of fleet units. A complete coverage of the world's oceanic areas to the detail required by present operations is not possible in the time frame of the next few decades with the available facilities. A new approach to this problem through the use of space instrumentation should be investigated to meet these Navy requirements.

The National Academy of Science will establish a committee on geodesy to examine the application of new generation of space-borne instruments to geoidal and earth gravity measurements from outer space.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, MICROMETEOROLOGY IN A MARINE ATMOSPHERE
S.L. Gathman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680235)

To perform micrometeorological measurements in the maritime environment for establishing a climatological data base in order to assess the operational capability of navy EO systems. To collect statistical micrometeorological data for deriving empirical models to relate eo propagation and standard meteorological parameters. To support the optical signatures program (OSP) and other EO test programs at the San Nicolas Island test site.

At San Nicolas Island, California, a marine atmospheric research facility with a 20 meter tower has been established close to the EO over water optical test path. Both profile and bulk aerodynamic atmospheric measurements are made to characterize the water vapor, aerosol, refractive index, turbulence, flux, and stability as well as, the standard meteorological variables. In addition, aerosol size distribution and atmosphere Radon 222 measurements are performed. The data is reduced in the field by

computer and stored on magnetic flexible disk. After post-experiment data reduction, the data is periodically reported and made available in printed reports, on microfiche, and on digital magnetic flexible disk.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Systems Center

5.0015, DEVELOPING AND TEACHING SHORT COURSES IN STATE OF THE ART REMOTE SENSING TECHNIQUES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0016, THEORY OF COHERENT POLARIZATION-DIVERSITY RADAR IN METEOROLOGY

J.I. Metcalf, Georgia Inst. of Technology, School of Geophysical Sciences, Dept. of Meteorology, *Atlanta, Georgia* 30332 (ATM78-11601)

A new technique of great potential value for remote atmospheric measurement has been identified and will be investigated theoretically. The technique involves the use of a coherent polarization-diversity radar to obtain the power spectra of received backscatter signals in two channels (right and left circularly polarized) and the cross-spectrum of the two signals. Theory which has already been developed for non-coherent polarization-diversity radars can be adapted to the interpretation of the spectral functions. In the case of backscatter from rain, the derived spectral functions can be used in conjunction with independently known quantities (fall speed, scattering cross-section, and ellipticity as functions of drop size) to obtain the size distributions of drops and to separate unambiguously the Doppler velocity components due to drop fall speed and air velocity.

During this program the theory will be refined to include ice crystals, snow and hail. Key points to be studied include the relationships of the spectral functions to meterological parameters, the accuracy with which the latter can be derived from radar measurements, and the practical limits due to atmospheric turbulence, propagation effects, received sensitivity, and isolation between the receiver channels.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0017, CARBON-14 ASSAYS IN THE STRATOSPHERE

P.R. Fields, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (000510; W-31-109-ENG-38)

Nuclear detonations have greatly increased atmospheric 14C above prebomb cosmic-ray background concentration with more than 99% of total 14C in the form of CO2. Measurements of the excess 14C content of CO2 samples collected on molecular sieve material at several altitudes in the stratosphere thus provide NOAA with an ideal tracer for studies of the circulation, mixing, and diffusion of carbon dioxide in the atmosphere. The sieve material is loaded into a separate collection apparatus and carried to altitude on many of the scheduled balloon flights made by the Environmental Measurements Laboratory. On completion of the flight, the sieve material is transferred to canisters and shipped to ANL for separations, purification, and 14C assays. Since the adsorption properties of molecular sieves are considerably different at low pressures and temperatures, we are undertaking a study of the sieve characteristics for other atmospheric constituents (e.g., fluorocarbons and oxides of nitrogen) at simulated collection altitudes. These data will provide a basis for the modification and/or redesign of the CO2 collection apparatus to extend its application to the efficient collection of a number of other important molecular constituents of the stratosphere in a single mission.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0018, INTERANNUAL VARIABILITY OF CROP-RELATED METEOROLOGICAL DATA FIELDS

J.E. Walsh, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Atmospheric Sciences, *Urbana, Illinois* 61801 (ATM79-20014)

This project extends a previous study that established statistically significant relationships between anomaly patterns of U.S corn yields and associated atmospheric fluctuations. The new effort includes three items: 1) A reprocessing of precipitation data in order to establish higher correlations between precipitation and crop yields. 2) An investigation of the use of Pacific Ocean sea-surface temperatures as statistical predictors of yield-related variables. 3) Expansion of the geographical area of the data base from the continental U.S. to the entire Northern Hemisphere.

The project will concentrate on the statistics of the meteorological parameters and the implications of these statistics for inter-regional weather fluctuations on the monthly and seasonal time scales.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0019, DEVELOPING AND TEACHING SHORT COURSES IN STATE-OF-THE-ART REMOTE SENSING TECHNIQUES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0020, NAVY ENVIRONMENT - UNDER-ICE ROUGHNESS

L.A. Leschack, Leschack Associates Ltd., *1111 University Blvd. W., Silver Spring, Maryland* 20902 (DN675351; N00014-76-C-0757)

The objectives of the proposed work are: (a) to evaluate the geographical and temporal variability of the under-ice roughness parameters in the Arctic Ocean; (b) to determine if the roughness parameters seem to remain relatively constant with respect to one another for different geographical areas from year to year, thence, to determine whether this geographical variability can be well correlated with ridging intensity measurements derived from airborne data; and (c) to determine whether under-ice roughness parameters can be estimated from satellite remote sensing data.

Examine under-ice roughness parameters for geographical and temporal variability to determine quantitatively whether roughness variations can be grouped geographically. Attempt to correlate latest recorded under-ice roughness data with corresponding satellite data of the surface.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0021, SYNOPTIC ANALYSIS

H.D. Hamilton, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (DF581710; F19628-78-C-0138)

AF function - strategic offense and defense. Deficiency - lack of quantitative data define atmospheric hydrometeor distributions associated with synoptic scale meteorological patterns.

Perform analyses of synoptic meteorological patterns associated with flight track of specially instrumented cloud physics research aircraft. How development contributes - analyses developed permit climatological correlation of synoptic scale meteorological patterns with particle distributions, liquid water content, and other pertinent cloud physics parameters for quantitative assessment of environmental effect on aerospace operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, STRATOSPHERIC AEROSOL MEASUREMENTS
H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF583610; F19628-79-C-0130)

AF function - environmental impact of stratospheric flight operations and optical propagations through the stratosphere such as surveillance, guidance, communications and target acquisition. Deficiency - information currently extant on aerosol particle distributions and employed as inputs by the modelling community may be grossly in error insofar as the stratosphere, and possibly even parts of the troposhere, is concerned. Objective - conduct two balloon borne measurements of aerosol size distributions and altitude profiles to confirm the earlier initial measurements are accurate and do in fact represent a new, correct description of the aerosols. How research contributes - these measurements will definitely increase the confidence in the technique and provide sufficient new data to enable modellers to incorporate the aerosol results into af models for environmental assessments and optical propagation studies.

The existing, unique, aerosol counter will be prepared for balloon flights to be launched from Holloman Air Force Base. Specific flight profiles consisting of a rise to maximum altitude, descent to 60,000 ft., rise to maximum altitude followed by termination will be used to investigate possible balloon wake contamination and to obtain redundant altitude profiles for verification. The raw data is to be analyzed using the laboratory calibrations and the data presented in graphs and tabular format.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, GLOBAL TRANSPORT PROCESSES AND INTERACTIONS WITH TRACE CONSTITUENTS
R.E. Newell, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (006443; 80-EV02195)

We are trying to understand the large-scale energy budget of the atmosphere-ocean-cryosphere system with the hope that we may then arrive at rational explanations for the observed changes in the energy budget. There has been much speculation that anthropogenic carbon dioxide, or tropospheric aerosol may, or will soon, influence climate. There has also been much consideration of possible changes of ozone to anthropogenic effects and the resulting possible changes on ultraviolet radiation received at the ground and on climate. It is desirable to understand in detail the operation of the system as it is presently constituted before one attempts to gauge the influence of potential changes. Our approach has been to study global observations in an effort to gain this understanding. Global data on wind, air, and sea temperature, pressure, moisture, and other trace constituents are studied. Computations of means, variances and covariances, empirical orthogonal representations, and trends are made. Correlation between results and measurements of total ozone, volcanic eruptions, stratospheric and tropospheric aerosol, and food production in several countries is developed. Computation of radiative heating rates by trace substances, such as carbon dioxide, water vapor and ozone is made. The data base for atmosphere and ocean has been developed at MIT. The ozone data was obtained from Atmospheric Environment Service, Canada.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0024, SATELLITE DATA PROCESSING AND ANALYSIS
R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF247630; F19628-76-C-0244)

AF function - airborne surveillance, target acquisition. deficiency - atmospheric density variations with time and space cannot be accurately predicted. Research - direct density measurements with satellite-borne accelerometers. Results are correlated with solar-geophysical parameters and other experiments. How research contributes -permits accurate determination of Air Force satellite ephemerides.

A SETA accelerometer is to be flown on Air Force satellites. This instrument permits high accuracy, high resolution atmospheric density measurements. Telemetry data from all the experiments will be provided on tape. The raw SETA data will consist mainly of drag accelerations which are proportional to density and accelerations due to vehicle motions caused by thrusting. Digital filtering methods are used to determine those accelerations due to drag. Density is calculated directly from the drag data. These results are used to accurately determine the orbit of the satellite. In addition the density results are used to developing accurate atmospheric models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, MESOSCALE WIND ANALYSIS AND PREDICTION
H.A. Brown, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584340)

AF function - weather forecasting for milirary operations, such as launch and recovery of aircraft. Deficiency - USAF lacks methods of incorporating mesoscale wind variability into operational forecasts. Objective - to evaluate small-scale horizontal and vertical variability of wind under influence of terrain, large-scale weather systems, diurnal effects, and severe convective weather and to develop short-range prediction techniques that yield probabilities of significant wind categories. How development contributes - investigation will provide the tools for incorporating small-scale wind variability into operational forecasts.

Data from the AFGL mesonetwork, the Otis test facility and conventional weather radar will be subjected to extensive reduction and analysis to develop temporal and spatial correlation statistics in the time range of 5 minutes to 1 hour. Statistically-based prediction models which yield probability estimates of wind conditions will be developed for forecast intervals up to 2 hours. Various approaches to developing a low-altitude wind warning capability will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AIR LAUNCHED BALLOON TECHNIQUES
A.S. Carten, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580610)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all weather operational lighter-than-air (LTA) vehicle or platform to put high altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves in-house studies and investigations leading to the design, fabrication and test of an advanced prototype air-launched balloon system (ALBS). When the goals of this research are achieved it will be possible for the Air Force to deploy and inflate in mid-air, automatically and quickly, LTA platforms capable of supporting payloads of at least 200 lbs for 24 hours at altitudes of 70,000 ft or better. This capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low cost substitute aerial platforms for communications relays like those presently carried on space satellite systems. TAC ROC 305-75 points up the need for such a substitute and specifically mentions lta platforms.

The basic design configuration of the cryogenically-inflated ALBS has been worked out under IHWU 66651101, in which scientific balloons were chosen as the primary drop vehicles. Using data from that program, a more sophisticated, aircraft-oriented version of the system will be developed under IHWU 76591101 which will meet the stringent standards required of aircraft-borne equipment. To accomplish this goal the parachute system tested and refined during FY77 at the National Parachute Test Range will be adapted to the new hardened version of the ALBS and subjected to qualification tests at the NPTR. The ALBS balloon design will be modified as required to reflect any needed design improvements identified in the IHWU 66651101 test program. Also, the ALBS cryogenic gas storage and heat storage transfer unit used on that program will be redesigned by NBS, as a single Dewar of the required capacity

and a model of this design will be procured in for the planned test series. When the new aircraft-qualified system is assembled it will be launched over the WSMR at the designed operational altitude of 25,000 ft. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, LARGE SCALE CLOUD SYSTEMS

L.V. Delgado, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581340)

AF function - military operations involving Air Force vehicles and erosion effects on nosecones during re-entry. Deficiency - there is a need for statistical information on hydrometeor size distribution and crystal habit for weather erosion programs and for their effects on systems operated on high-performance aircraft. Objective - to measure, describe and develop prediction techniques for the microphysical characteristics of clouds. How research contributes - this research will provide a broader data base for characterizing hydrometeors in large scale cloud systems and will advance our understanding of these cloud systems.

Data collected during past years on ABRES and minuteman weather erosion programs will be reviewed and combined with new hydrometeor data obtained with improved instrumentation on the present program to provide suitable statistics for hydrometeor characterization. New sampling instruments will be developed and flown to enable more accurate measurements to be made of hydrometeor sizes and crystal habits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, IONOSPHERIC MONITORING TECHNIQUE REFINEMENT

W.N. Hall, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580960)

AF function - communications, surveillance and navigation at high altitudes. Deficiency or opportunity - ground-based ionospheric and geophysical data inputs to the space environmental support system (SESS) are being squeezed by increasing costs and decreasing resources. Objective - to develop methods to transform remote ground-based ionospheric and geophysical measurements into forms suitable for convenient, automatic use by SESS and Air Force systems. How research contributes - automation of the functions of AF and contractor observers would reduce the cost of acquiring ground-based ionospheric and geophysical data inputs to SESS. Automation would counteract recent cost increases, prevent further loss of ground-based data sources, and increase the quantity and quality of ionospheric and geophysical data input to SESS.

The procedures used by the observers for reducing and reporting SESS data will be defined and analyzed. Analytical algorithms for automating the data reduction will be developed by computer simulation. The analytical algorithms will then be adapted for implementation in firmware in mini- or microcomputer systems. A SESS data communicator (SESSDAC) prototype will be developed under AFGL laboratory director's fund project ILIR8B. This will be a parallel effort to develop a hardware system for implementation of the analytical algorithms. The prototype will be applicable for use at all AWS sites reporting SESS data to AFGWC. The use of existing sensor systems, communication links, and data message formats will minimize the effort by AWS to utilize the automatically analyzed SESS data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ENERGY TRANSPORT IN THE SUN

S.L. Keil, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584760)

AF function - communications, surveillance, detection, tracking. deficiency - inadequate knowledge of solar environment, disturbances and physics limits ability to predict events that disrupt and degrade af systems. Objective - to determine how the various scales of velocity cells and magnetic features extant on the sun affect and effect the transfer of energy from the interior of the sun through the outer layers and into the interplanetary medium. How research contributes - recent studies have implied that active region formation is connected with the existence of very-large-scale velocity cells on the sun. By studying the heirachy of these cells we hope ultimately to be able to define the nature of this process and how it leads to the formation of flares that affect AF systems.

Measurements of height variations of velocity and magnetic fields in the solar atmosphere will be made at the Sacramento Peak Observatory (SPO) tower telescope (TT) with the Lockheed Universal Filter. Supergranule flow fields as a function of height will be studied by utilizing observations made with the SPO TT and the ultraviolet spectrometer/polarimeter on the Solar Maximum Mission satellite. A search will be made for strong horizontal flows beneath the solar surface by analyzing observations of five-minute oscillations made at the SPO TT. An attempt will be made to identify the mechanism responsible for recently-discovered intermediate-scale (7 to 10 mm) granulation. Solar convection will be studied theoretically through solution of the anelastic modal equations. Time-dependent spectra of granulation and/or supergranulation will be taken at the SPO TT and analyzed to determine the time development of these flows. A theoretical investigation of the action of convection on magnetic flux tubes will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, INVESTIGATION OF HIGH RESOLUTION SOUNDING TECHNIQUES

R.A. McClatchey, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584540)

AF function - weather forecasting, weapons delivery, surveillance. Deficiency - inability to retrieve temperature and moisture profiles from satellite radiances. Objective - investigate the advantages and disadvantages of high spectral resolution radiance measurements in remotely determining the temperature and moisture structure of the atmosphere. How research contributes - improves the ability to analyze and forecast atmospheric parameters of importance to military operations, particularly over data-sparse or data-denied areas.

High spectral resolution (HITRAN) transmission calculations will form the basis of an investigation of the potential improvement in vertical resolution of remotely sensed temperature and moisture through the applecation of high resolution measurements. Initial efforts will concentrate on the effect of the atmospheric structure on the radiation emitted to space. High spectral resolution (0.1 wavenumber) measurements planned with the cryogenic interferometer developed and flown under task 2310G1 will be compared with HITRAN generated radiances. A recommendation of the utility of high spectral resolution techniques for the remote sensing of meteorological variables is expected as a result of this work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, DEVELOPMENT OF NEW TECHNIQUES FOR FLARE PREDICTION

D.F. Neidig, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583170)

AF function , - communications, surveillance detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to develop techniques for improving predictions of solar flares. How research contributes - reliable prediction of flare-induced geophysical disturbances is needed to assure optimum performance and design criteria for AF communication, detection and navigation systems. These predictions require continuous magnetic field data such as the solar observing optical network (SOON) can supply. New techniques for the measurement and interpretation (within a flare-forecasting framework) of magnetic fields and other physical parameters need to be developed in order to achieve the required prediction capability. The effort in this

IHWU is directed toward the identification and early detection of the solar conditions, leading to flares.

To predict solar flares and their associated geophysical disturbances requires - (1) identification of solar active regions which will be flare productive, (2) detection and early recognition of flare phenomena (before geophysically significant emissions occur), (3) real-time evaluation of flare characteristics which lead to geophysical effects. Observable parameters relating to these areas, collected from optical, radio, and magnetic data, will be systematically evaluated in order to determine the parameters which are most significant in predicting both the occurrence of flares and their geophysical importance. New techniques for the measurement and interpretation of solar magnetic fields and other physical parameters will be tested for application to the soon telescopes, these, in turn, will add to the data base of possibly significant flare parameters. The procedure will use a multivariant discriminant analysis (MVDA) which, in addition to identifying significant parameters, is also capable of making flare predictions from active region data. Optical data from the AWS-SOON network, as well as microwave data from supporting contracts, will be incorporated with observations made at Sacramento Peak Observatory in order to determine the significance of suggested prediction parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, SPACECRAFT SHEATH MODEL 1

A.G. Rubin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249040)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the plasma physics interactions responsible for spacecraft charging are not well understood at present and it is necessary to develop appropriate models in order to obtain this understanding. Objective - to develop descriptions of the plasma and energetic particle environment surrounding a spacecraft at high altitude and its spatial and temporal behavior. How research contributes - numerical simulation of plasmas techniques are employed to model the plasma physics interactions of the ambient environment with the spacecraft. Understanding of the interaction and the ability to model sheaths, beams, secondary effects and instabilities will contribute vitally to the solution of the spacecraft charging problem.

A spherically symmetric code has been developed employing a numerical simulation model. The motion of several thousand particles in the field of the spacecraft and their self-consistent field is followed. The code includes the quiet start technique, cloud in cell particle treatment, and distribution function smoothing. Photosheath effects are treated, as well as secondary electrons and electron and ion guns. Quantities calculated are the satellite potential, the sheath structure and the current to the satellite.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, MISSILE CEP IMPROVEMENT FROM IMPROVED GRAVITY MODELS

B. Szabo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582900)

AF function - strategic weapons delivery. Deficiency - current gravity models are inadequate to satisfy CEP goals of advanced ICBM's in the mid 1980's. Objective - determination of the impact errors of advanced long range ICBM's by utilizing improved regional and global gravity models. How research contributes - determines expected ICBM impact errors due to various gravity models.

Gravity models (launch region and global) derived by new combination technique and from new gravity data (such as satellite alimetry) will be used for the determination of the omission and commission errors of the global model. This error will be combined with the launch region gravity model, GM, and launch site gravity errors for the total gravity dependent error of an advanced ICBM.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Terrestrial Sciences Div.

5.0034, DESIGN & MODIFY MOBILE TM STA/SUPPORT

J.C. Erickson, New Mexico State University, Las Cruces Campus, Physical Science Lab., *P.O. Box 548, Las Cruces, New Mexico* 88070 (DF580140; F19628-78-C-0070)

AF function - remote balloon flight support capability. Deficiency - lack of Air Force mobile computer-interfaced PCM telemetry and command control facilities applicable to balloon control from remote locations. Objective - provide state-of-the-art telemetry and balloon control facilities at AFGL Mobile Ground Station. How research contributes -increases the versatility and cost effectiveness of scientific balloon platforms by providing experimenters the capability for high data rate PCM telemetry reception and balloon control functions from a mobile ground station at remote sites.

Design and fabricate special computer interface and display equipment for a PCM ground station. Provide hardware and software interface for the mobile station-installed equipments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0035, DESIGN, DEVELOPMENT, MEASUREMENT & FABRICATION OF L- & C-BAND ANTENNAS FOR USE ON C-130 AIRP AIRCRAFT MULTI-FREQUENCY MICROWAVE RADIOMETER

K.R. Carver, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-95509)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0036, NAVY ENVIRONMENT - ATMOSPHERIC ION CHEMISTRY

V. Mohnen, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Earth Sciences, *1400 Washington Ave., Albany, New York* 12222 (DN923067; N00014-76-C-0283)

The objective of this research is to understand better the formation and role that ions play in the photochemistry and electrical conduction of the atmosphere. These two problems are further involved in the solar terrestrial reaction problem and also in the cloud physics of nucleation and charge separation. Solution of some of these problems would benefit several aspects of support to Navy operations including weather prediction and EOMET.

The approach to this research is through laboratory simulation using known concentrations of various trace gases in pure mixtures of the principal air components. The principal tools of the research are a plasma chromatograph backed up to a mass spectrometer. The results are cross checked with the mathematical simulations done at NCAR and the chemical simulations in the NOAA laboratory at Boulder.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0037, REMOTE SENSING CENTER

K.P. Ferguson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *APO, c/o American Embassy, New York, New York* 09697 (9390-620G)

The primary objective of this project is to develop and maintain a LANDSAT image reference file comprised of various types of enhanced and standard imagery for application by scientific staff of the Directorate General of Mineral Resources and foreign geologic missions. A second objective is to develop and maintain a research facility for analysis of LANDSAT imagery and other remotely sensed data. A third objective is to provide design specifications and local coordination for production of various types of LANDSAT mosaics. A fourth objective

is to compile geographic data by field survey methods for use in geographic maps with LANDSAT mosaic bases. A fifth objective is to continue coordination of training for local scientific staff in remote sensing technology.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0038, LIDAR ENGINEERING STUDY
Unknown, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DF584070; F19628-80-C-0062)

AF function - vehicle tracking, RV trajectory, prediction, interception, satellite re-entry. Deficiency - insufficient information on a timely basis of atmospheric density and its variations in the lower and middle atmosphere as required by advanced re-entry systems and in the lower and middle atmosphere as required by advanced re-entry systems and in the lower thermosphere for satellite re-entry predictions. Objective - development of LIDAR sounder for remote sensing of atmospheric properties and monitoring the density and temperature of the middle atmosphere. How research contributes - LIDAR techniques have potential to provide density and temperature measurements in the atmosphere (15-105 km) with resolution and accuracy comparable to present rocket-borne meteorological sensors. In addition to cost benefits, remote sensing techniques such as LIDAR are the only adequate means for obtaining sufficient synoptic data for mesospheric studies.

Current laser technology has demonstrated the feasibility of this application. Engineering design study and evaluation will be conducted towards the development and fabrication of a laboratory operated LIDAR system to be later packaged into a transportable unit for studies at different geographic locations in conjunction with radar backscatter measurements and rocket field programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, DIRECT OBSERVATIONS OF THE INTERIOR CHARACTERISTICS OF OKLAHOMA THUNDERSTORMS DURING SESAME
P.L. Smith, South Dakota School of Mines & Technology, Inst. of Atmospheric Sciences, *Rapid City, South Dakota* 57701 (ATM78-27018)

This study involves collection and analysis of direct observations of the interior characteristics of Oklahoma thunderstorms during the Severe Environmental Storms and Mesoscale Experiment (SESAME) field program. The emphasis of the research is on determining the thermodynamic characteristics and the vertical air motions in the storm interiors, as well as the hydrometeor (cloud droplets, raindrops, graupel, hail, and other particles) characteristics and growth processes. The analysis of the observations is directed towards improved understanding of the intrastorm processes and the storm-environment interactions, including studies of entrainment processes. The analysis is being carried out in coordination with the analysis of the other aircraft, radar, surface, and satellite meteorological observations to be collected under the SESAME Storm Scale Sub-Program.

The observations are obtained using an armored T-28 aircraft equipped with an elaborate meteorological instrumentation system and digital data recording equipment. The work is being conducted as a cooperative endeavor involving the South Dakota School of Mines and Technology, the National Center for Atmospheric Research, and the National Severe Storms Laboratory.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0040, THE STUDY OF ION CONVECTION ELECTRODYNAMICS FOR THE UPPER ATMOSPHERE RESEARCH SATELLITES (UARS) PROGRAM
R.A. Heelis, University of Texas, Dallas Campus, Center for Space Sciences, *Richardson, Texas* 75082 (NAS 5-26174)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0041, APPLICATION OF MAGSAT TO LITHOSPHERIC MODELING IN SOUTH AMERICA (ABBREV)
G.R. Keller, University of Texas, El Paso Campus, School of Science, Dept. of Geological Science, *El Paso, Texas* 79902 (NAS 5-26326)

Application of MAGSAT to lithospheric modeling in South America: Synthesis of geologic and seismic data for development of integrated crustal models.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0042, SCIENCE SUPPORT FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE)
W.L. Smith, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 1-16507)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0043, LOW-LEVEL MONSOON WIND DYNAMICS
J.A. Young, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meterology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM78-25503)

The object of this research is to carry out a sequence of observational, modeling and theoretical studies directed toward development of a unified understanding of monsoonal flows in the lower levels of the atmosphere. Special emphasis will be given to conducting unique satellite and aircraft observations of planetary boundary layer flow over the Arabian Sea during the GARP Monsoon Experiment (MONEX). The satellite is a U.S. geostationary satellite that will be over the Indian Ocean. The aircraft observations will be made from the National Center for Atmospheric Research's (NCAR's) aircraft the Electra, on which the P.I. will be one of the principal scientists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AIR REFUELING PART-TASK TRAINER IOT&E
T. Gray, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF200000)

The purpose of the initial operation test and evaluation (IOT&E) of the B-52 aerial refueling part-task trainer (ARPTT) is to determine the utility of using this system as an alternative to aircraft flight training for B-52 pilots. In order to make this determination, three studies will be performed simultaneously. Two of these study skill acquisition, the third deals with highly experienced pilots and investigates skill maintenance and re-acquisition. In addition, the effectivenss on the ARPTT in training instructor pilots will be determined. Finally, task frequency data on initial skill acquisition will be collected and analyzed for SAC ISD syllabus development.

The three studies will use a transfer of training methodology in which matched groups of subjects undergo a test-treatment-post-test procedural sequence. In studies 1 and 2 this methodology will incorporate proficiency advancement in order to accurately assess the training contribution of the ARPTT. Study 3 is essentially a classical learning/retention paradigm. The instructor pilot training uses a job sample approach based on real-world tasks. The statistical model for all studies follows a univariate group-by-treatments analysis of variance. The primary dependent variables are quantitative with questionnaires and expert ratings providing supplemental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, SURFACE ATTACK TRAINING RESEARCH - STUDY I
T.H. Gray, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223900)

(1) To develop transition training and surface attack training syllabi for A-10 'B' course students in CCT, and (2) to determine simulator features/capabilities required for effective training in the air-to-surface mission. Under these two objectives (transition and surface attack training syllabi development) there are four sub-objectives - (1) syllabus development, (2) generation of objective performance measurement algorithms, (3) human factors evaluation of instructor/operator console design, and (4) assessment of utilization of ASPT training features for surface attack training.

The technical approach taken for satisfying sub-objective 1 follows previous AFHRL/FT syllabus development activities (i.e., the UTP IFS syllabus) which were based on isd principles. Essentially, a 'cut and try' method will be used that undergoes constant evaluation and modification to discover and solve training problem areas. Sub-objective 2 is a continuation of work in the performance measurement area. Sub-objectives 3 and 4 will be accomplished using questionnaires, af standards, and observations of subject matter experts. In a classical sense, sub-objective 1 has no independent variables per se. Four TAC instructor pilots (IPS) will use ASPT to train two classes, each consisting of six 'B' course students, on transition and surface attack maneuvers. The progress of these students will be carefully monitored by the IPS and automated performance measures (maneuvers and weapons delivery scores). Sub-objective 2 will follow the performance measurement methodology perviously established, wherein time-within-tolerance scores (derived from measured system parameters) are correlated with ratings assigned by subject master experts (the IPS). For sub-objectives 3 and 4, the IPS will be interviewed via standardized questionnaires to determine desired instructor/operator console design features and the value of advanced training features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, HUMAN FACTORS IN NIGHT OPERATIONS (ADVANCED REQUIREMENTS AND TRAINING TECHNOLOGIES) (TECH BASE)
K. Cross, Anacapa Sciences Inc., *2034 De La Vena St., P.O. Drawer Q, Santa Barbara, California* 93102 (DA644421; MDA 903-78-Q-AA41)

This work is designed to develop a map interpretation/terrain analysis training program for Army infantry which exploits the use of audio-visual aids for simulating navigation exercises. The initial work is concerned with the preparation of lecture slides and practical exercises using filmed simulation methods for improving map reading skills (i.e., contour interpretation, terrain analysis).

ARI has approved $30K to a Navy contract (see 17B) to ANACAPA Sciences, Inc. For the purpose of designing a map interpretation/terrain analysis course for Army infantry officers. ANACAPA Sciences, Inc. has previously developed a map interpretation/terrain analysis course for Army helicopter pilots flying at NOE altitudes.

SUPPORTED BY U.S. Dept. of Defense, Research Inst. for the Behavioral & Social Sciences, Org. & Systems Research Lab.

6.0004, MULTI-SENSORY CUE EFFECTS
W. Levison, Bolt Beranek & Newman Inc., *21120 Vanowen St., Canoga Park, California* 91303 (DF325750; F33615-80-C-0501)

The major thrust of this effort is the creation of a predictive pilot model which is sensitive to cues relevant to cockpit instrumentation, extra cockpit visual scenes and vehicle motion. The objective of this workunit is to take the technology developed thus far under task 2312V2 and extend it to extra cockpit visual scenes.

The approach will be to design a formation type flying task that can be run on the roll axis tracking simulator. AMRL personnel will run the experiment, collect data and perform preliminary data analysis. The reduced data will be supplied to the contractor from which he will perform model analysis to develop a molding philosophy of how extra cockpit visual cues are used.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Manned Systems Effectiveness Div.

6.0005, FIELD CARRIER LANDING PRACTICE TREND ANALYSES FOR NCLT TRAINING MODEL DEVELOPMENT
C. Brictson, Dunlap & Associates Inc., *La Jolla, California* 92037 (DN094017; N61339-79-C-0105-0018)

Development of a generic model of aircraft landing problems to be corrected (remediated) in the NCLT via diagnostic and remedial information provided by the generic model.

Analysis of over 2,000 A7 landings; validation of trend analyses on the basis of subject matter expertise and empirical determination of the relationships between particular diagnostic/remedial training in the simulator (NCLT) and operational aircraft performance.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0006, RECEPTOR ALTERATIONS AND STRESS
D. Feldman, Stanford University, Graduate School, *Stanford, California* 94305 (NCA 2-745007)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, HIGH INTENSITY ENERGY EFFECTS ON PHYSIOLOGICAL, BEHAVIORAL AND SUBJECTIVE RESPONSE
D.J. Hord, U.S. Dept. of Defense, Navy, Naval Health Research Center, Environmental Physiology Div., *San Diego, California* 92138 (DN077662)

Concern over the auditory effects of noise has resulted in extensive knowledge of effects of noise on hearing, the development of ear protectors and setting of noise level standards. Less interest has been shown and subsequently less is known about the non-auditory effects of noise. There is, however, growing interest in and concern over the non-auditory effects of noise as a biological stressor. In noise research increased attention is being given to the impact of noise on body tissue, sensory receptors, mood and behavior. Specific to this research, previous work suggests that, in addition to the effects on hearing, there are acute physiological and behavioral changes during maintenance operations in a jet engine noise suppressor (Hush-House, NAS, Miramar). Physiological dysfunction and behavioral changes attributable to the high intensity stimulation may also appear as chronic, degenerative or suppressed effects. This study will determine the effect of exposure on physiological, behavioral, and subjective responses.

Vestibular and oculomotor system integrity, brain stem auditory evoked potentials, sensory-motor coordination, balance, cardiovascular functions, and subjective reports will be measured before, during, and after Hush-House exposure to determine the noise effects. In addition to the physiological and behavioral measures, medical records, and medical complaints will be examined and a follow-up period of three years will determine if the exposure to noise produces chronic changes or delayed medical problems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research & Development Command

6.0008, USMC AIR NAVIGATION TRAINING
O.A. Larson, U.S. Dept. of Defense, Navy, Personnel Research & Development Center, *San Diego, California* 92152 (DN797567)

To develop a program for training Marine Corps fixed wing pilots in navigation and target acquisition techniques that will allow them to operate at low altitudes over unfamiliar terrain.

Map interpretation, terrain evaluation, and target acquisition techniques will be developed and evaluated. Materials and methods will be field tested using cinematic and sensor simulation support. Flight navigation problems specific to USMC operational requirements will be examined and recommendations forwarded. See supporting contract DN097591.

SUPPORTED BY U.S. Dept. of Defense, Navy, Personnel Research & Development Center

6.0009, BIOLOGICAL CONTROL SYSTEM FOR EXTRACELLULAR FLUID VOLUME REGULATION
N.S. Bricker, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NCC 2-104)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, NEUROPHARMACOLOGY AND THERAPEUTICS FOR AF CHEMICALS
M.B. Sterman, University of California, Los Angeles Campus, School of Medicine, Dept. of Anatomy, *2025 Zonal Ave., Los Angeles, California* 90024 (DF324730; F33615-79-C-0506)

The 6570 AMRL has been investigating the pharmacological and toxicological effects of certain missile propellants in order to more safely use such compounds in a manner dictated by good industrial hygiene and industrial medical practice. Previous research has established characteristics of the neurologic toxic response to monomethylhydrazine (MMH), a rocket propellant, and the significant influence of a variety of behavioral and neurophysiological variables on this response in cats and monkeys. MMH causes convulsions in these species, but perhaps of greater concern is the observation that subconvulsive doses can have subtile and prolonged measurable effects. Exposure to MMH can lead to changes in sleep-waking cycles and in performance of a learned task. The current and projected levels of MMH in propulsion systems require formation of specific and effective therapeutic regimens for accidental human exposures. In order to set standards for exposure criteria and to determine methods for combating the effects of MMH in exposed individuals, it is necessary to determine the exact mode of action of MMH on specific body functions and to test the efficacy of therapeutic measures to abort or prevent untoward effects of the agent.

A study will be conducted to advance the state-of-the-art with respect to the central nervous system effects of monomethylhydrazine (MMH). Recent research conducted by the University of California, Los Angeles, has demonstrated that experimentally-induced neurologic pathology can interact with MMH exposure in primates to accentuate toxicological effects, but this interaction can be influenced by anti-convulsant medication. Monkeys with induced neuropathology receiving phenobarbital as anticonvulsant medication react to MMH exposure in a manner similar to that of monkeys with no induced neuropathology. A variety of compounds known to be anticonvulsants or to facilitate presumed anticonvulsant electroencephalographic (EEG) changes will be evaluated for protective effects against mmh exposure. The compounds selected will represent appropriate examples from a number of generic categories. These drugs will be administered at several dose levels to normal adult cats and subsequently to rhesus monkeys with previously established seizure foci. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0011, PATHOPHYSIOLOGY OF MINERAL LOSS DURING INCREASED URINARY AND FECAL CALCIUM EXCRETION
C.D. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 9-16227)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0012, PHASE TWO DEVELOPMENT OF A COMPUTER ASSISTED DIFFERENTIAL DIAGNOSIS FOR MEDICAL INFORMATION SYSTEM
M.H. Weil, University of Southern California, School of Medicine, Dept. of Medicine, *2025 Zonal Ave., Los Angeles, California* 90033 (NAS10-9930)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

6.0013, DEVELOPMENT OF AN AUTOMATIC PRESSURE SUIT HEAD ENCLOSURE
R. Weis, International Latex Corp., *Frederica, Delaware* 19946 (DF323400; F33615-78-C-0610)

This procurement will develop an automatic pressure suit head enclosure to be assessed for possible use in advanced intercept aircraft. Requirements for mobility, visability, and maneuverability in a high G environment effectively exclude existing pressure suit helmets from this role. An automatically activated device is desired, which in the event of cabin decompression would deploy, encapsulate, and seal the head/neck area to an otherwise passive, pressurizable coverall. It will make maximum use of the normally worn helmet, mask, and oxygen regulator, and is expected to provide fighter-compatible decompression protection without traditional and unacceptable pressure suit penalties of added weight and encumbrance.

This effort is part of a coordinated effort to develop fighter-compatible high-altitude protective gear. Subsequent efforts will address development of an optimized overall, and integration of essential life support systems (i.e., G-protection, thermal conditioning, etc.), with assembly of a developmental prototype to follow. Development of acceptable head protection is being pursued first because it appears to be the single most critical ingredient to acceptance by the fighter community. Failure to obtain desired goals in this initial effort will permit reevaluation, revision or cancellation of program plans with a minimum of time and fiscal loss.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, HIGHER PLANT SPECIES SELECTION CRITERIA FOR A CLOSED ECOLOGICAL LIFE SUPPORT SYSTEM - PHOTOSYNTHETIC AND NUTRITIONAL ASPECTS
C.A. Mitchell, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NCC 2-100)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, EFFECT OF SIMULATED SPACE FLIGHT ON INTERFERON PRODUCTION AND ACTION
G. Sonnenfeld, University of Louisville, School of Medicine, Dept. of Microbiology & Immunology, *101 W. Chestnut, Louisville, Kentucky* 40202 (NCA 2-400101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0016, CUTANEOUS FLUID AND ELECTROLYTE LOSSES IN WEIGHTLESSNESS
K.W. van Beaumont, St. Louis University, School of Medicine, Dept. of Physiology, *1402 S. Grand Blvd., St. Louis, Missouri* 63104 (NAS 9-16231)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0017, ASPECTS OF VISUAL SEARCH ACTIVITY RELATED TO ATTENTIONAL PROCESSES AND SKILL DEVELOPMENT
J.A. Stern, Washington University, School of Arts & Sciences, Dept. of Psychology, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF055400; F49620-79-C-0089)

AF function - flying an aircraft involves critical decision-making based on visual information. Inasmuch as the eye is the

sensing system for visual information, it would be profitable to analyze eye movements recorded in operational settings. Deficiency - adequate data sources are not yet available which allow making inferences about the adequacy of a pilot's visual search activity and about state dependent changes in a pilot's ability to take in and process visual information. Both adequacy of visual search in the alert pilot and change in the state of alertness affect performance. Objective - the research will identify momentary (phasic) and tonic changes in alertness and lapses of attention using eye movement parameters and relate periods of altered state to changes in performance, both decision-making and motor response. How research contributes - since operation of complex instrumentation involves periods of scanning and anticipation, measures like parameters of eye movements, which can be used to assess change of state during these periods, are more useful in operational conditions than measures of the outcome of performance. Defining periods during which performance decrements can be expected on the basis of the proposed ocular measures including eye blinks may be a more sensitive and useful approach since such measures can be obtained under operational conditions rather than being restricted to the laboratory, and allow corrective action to be taken before performance decrements significantly impair performance.

Three experiments will be conducted - (1) determine the relationship between change in oculomotor indicants of fatigue and change in performance measures such as whether increased eye blink closure duration during one period is predictive of performance decrements in a subsequent period, (2) based on results in experiment I, determine the precise procedure using eye movement parameters to predict and reduce drop-outs in performance, and (3) further examine the test-retest reliability of the resulting ocular measures as indicants of fatigue in order to increase the generalizability of results. In experiments I and II a complex divided attention task simulating demands made on Air Force personnel will be performed. Experiment III will use a reading task, which is a well-practiced task allowing comparison of the test-retest reliability of the oculomotor indices. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0018, PROJECT 5973 SUPPORT

D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321190)

His work unit will continue to support Project 5973, development of visually coupled aids, with technical support following transition of the engineering development program to ASD/AE. This support, in accordance with transition guidelines, will include both technical and human factors inputs to the hardware development as well as the test and evaluation phases of the program. Through such inputs the program will be provided with necessary technological advances, performance measures on candidate VCS subsystems, and interface criteria for VCS components in various applications testing. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, and PMDR-P2033(5)/64708F/ 5973, visual coupling aids.

Promising VCS component technology will be developed to the point where it can be incorporated into the 6.4 program in ASD/AE. Technical and human factors inputs will be provided to test efforts such as single seat attack (SSA), visual aided tracking system (VATS) and project quick strike. This includes support for both ground-based simulation as well as flight testing. Measurement data on various VCS component capabilities will be provided using the image metric laboratory and, in some cases, final acceptance testing of deliverable systems will be performed. Helmet integration of VCS components will be pursued and basic helmet development and interface work will be applied where appropriate. Methodology for providing an efficient, timely flight test support capability will be evolved and coordinated with ASD/AE on a regular basis.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0019, ELECTRONIC WARFARE CREW STATION DESIGN AND PERFORMANCE ASSESSMENT

E.D. Sharp, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF316620)

The objective of this work unit is to integrate B-52 electronic warfare (EW) crew station design with emphasis on improving the utilization and effectiveness of the operator as part of the weapon system. In-house and contractual efforts through real-time simulation yield control display criteria for specific designs, overall crew station designs and technology advancements suitable for future applications.

The approach to this effort is to make maximum use of real-time, man-in-the-loop simulation to define, quantify and analyze operator performance in present and future EW crew stations, establish criteria for control display layout system integration and crew performance workload and workload distribution. Controlled mission conditions will be simulated to investigate systematic changes in crew station designs with respect to overall workload and operator performance as a result of the addition of prototype systems.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0020, AFTI/F-16 ACCELERATION PERFORMANCE EVALUATION

R.E. Van Patten, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF326410)

The upcoming generation of six-degree-of-freedom (6DOF) aircraft typified by the AFTI/F-16 will subject pilots to new acceleration environments by combining 6DOF capabilities with those of conventional aircraft. The objective of this work is to quantify the effects of these 6DOF generated acceleration environments on pilot performance in air-to-air and air-to-ground combat, and to investigate principles for new seats and restraints suitable for use in 6DOF aircraft. The early work in this effort will be focussed on critical AFTI/F-16 restraint problems which must be quantified in order to meet airframe and pilot-vehicle interface (PVI) deadlines as scheduled by the AFTI/F-16 ADPO (AFFDL/FI) and the contractor, General Dynamics. A memorandum of agreement between AFFDL/FI and AFAMRL/BBS has been approved to cover current and out year research in this area.

The general approach will involve man-in-the-(control)-loop experimentation using the AFAMRL dynamic environment simulator (DES) which is a multi-gimballed human centrifuge. Research will concentrate on AFTI/F-16 restraints and biodynamic cross-coupling between rudder pedals and the side stick controller induced by the lateral acceleration forces commanded by rudder inputs. Subsequent experimentation will advance into simulation of air-to-ground and air-to-air engagements using both conventional airframe motions compared to 6DOF aircraft capabilities. Theoretical work will be merged into these experiments in order to exploit previous work in the development of mathematical describing functions of pilot tracking performance.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0021, AEROSPACE BIOTECHNOLOGY RESEARCH SERVICES

J. Militello, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF317290; F33615-78-C-0501)

Many unforeseen problems arise during the conduct of the laboratory's R&D programs, requiring special and immediate assistance that is available only through a call-type contract. This contract effort provides whatever expertise is necessary for rapid solution in these situations. This is an extremely cost-effective method of supporting all areas of research and exploratory development of the laboratory including biodynamics, bioacoustics, toxicology, crew safety, human engineering and performance studies as well as related support of many AF development and operational systems.

This contract provides intermittent studies, analysis, experimentation and technical services for all areas of the laboratory

technical program, thereby avoiding costly delays in mission activities. Tasks are fully described through the contracting office and made on a call basis.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0022, AIR POLLUTANT PRODUCTION BY ALGAL CELL CULTURES

F. Fong, Texas A & M University, College Station Campus, School of Agriculture, Dept. of Plant Sciences, *College Station, Texas* 77843 (NCC 2-102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0023, MAINTENANCE OF AIR FORCE HUMAN RESOURCES DATA BASE - CONTINUATION

C.C. Fresne, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF232750)

Continuation of 63230101 - to collect, document, maintain, and update automated personnel data for Air Force officers, enlisted personnel, and the civilian work force. To organize these data in readily accessible data bases for support of research studies of the personnel system.

Automated standard and command-unique personnel data files will be acquired, edited, and reformatted. Data for all military accessions, flying and technical training, reenlistment and separations, and strength files will be included. Nonautomated documents containing performance and evaluation data will be acquired and converted to machine-compatible form. Milestones - Apr 78 & annually, complete CY 77 update of Basic Military Training File. Apr 78 & annually, complete processing of Dec 77 UAR/UOR Active. May 78 & annually, complete processing of FY 77 Navigator Detailed History File. Jun 78 & annually, complete CY 77 preparation of AFOQT data. Aug 78 & annually, revalidate requirements for continuing receipt of approximately 30 source files including UAR/UOR Active (tri-annually), UAR/UOR Reserve/ANG (annually), Technical Training (quarterly), Basic Military Training and OTS (monthly), Flying/Navigator Training (annually), etc. Oct 78 & annually, complete processing of Jun 78 UAR/UOR Active files. Dec 78 & annually, complete processing of Sep 78 UAR/UOR ANG/Reserve files. Jan 79 & annually, complete processing of Sep 78 UAR/UOR Active Files. Feb 79, completed processing of Sep 78 AFROTC Applicants/Advanced/Commissioned Losses files. Mar 79, completed processing of CY 78 Technical Training File.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0024, DETECTION AND MEASUREMENT OF AMINE-BASED PROPELLANT VAPORS

L.J. Luskus, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320860)

This work unit will develop detection methodology and breadboard instrumentation to measure toxic and subtoxic concentrations of amine-based propellants including hydrazine, MMH and UDMH. The requirement is based on occupational safety of workers involved in rocket testing, missile maintenance, and more recently in the projected world-wide deployment of F-16 aircraft which employs a hydrazine fueled emergency power unit.

Electrochemical and chemiluminescence instrumentation will be developed and evaluated for use as area and confirmation monitors. Personal dosimeters will be developed contractually with final evaluation testing accomplished under this work unit. Solid state devices and wet methods for field use will be developed and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, TREATMENT OF AIRSICKNESS IN AIRCREW UTILIZING BIOFEEDBACK TRAINING, AUTOGENIC TRAINING, AND PSYCHOTHERAPY

R.A. Lvey, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324340)

Develop a cost effective treatment program for rehabilitating airsick aircrew, without using medication, utilizing self-monitoring physiological instrumentation, autogenic training and psychotherapy.

USAF aircrew with operationally significant airsickness may be referred to USAFSAM aeromedical consultation service for evaluation and consideration for the rehabilitation study. If found medically and psychiatrically fit, they will undergo a regimen of biofeedback conditioning, autogenic training and psychotherapy (as required). Upon completion of the program they will be returned for an immediate operational trial.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0026, MECHANICAL ANTI-G PROTECTION SYSTEMS

R.M. Shaffstall, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322320)

Research and development mechanical devices which aid in counteracting the physiologic effects resulting from exposure to accelerative forces (G).

Various types of mechanical devices will be developed (including fabrication) in-house and tested for their anti-G benefits using both animals and humans as experimental subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, CONTACT LENSES & KERATOCONUS

T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323030)

The objective of this work unit is to evaluate and follow selected USAF aircrew personnel with visual disorders, principally corneal, requiring contact lenses to maintain their visual function. Particular emphasis will be placed on those individuals with irregular astigmatism and keratoconus. This work unit will also include a group of individuals who prior to entering flying training had refractive errors altered by a technique known as orthokeratology. A small number of patients who underwent this form of 'treatment' and who appear to be developing a corneal dystrophy (keratoconus) have now been identified. The possibility has to be explored that this may have been hastened or caused by the orthokeratology procedure. The permanence of this procedure (alteration of the refractive error) has been questioned and therefore follow-up examinations might better help in answering these questions.

Patients to be included in this study will be identified primarily from referrals to the Aeromedical Consultation Service from base-level flight surgeon's offices Air Force-wide and to a lesser extent from MAJCOM and HQ USAF referral. Referral will usually be based on the fact that the patient cannot be corrected to 20/20 visual acuity with spectacle lenses. The scope of each evaluation will be dictated by those elements indicated from the patient's condition. Extensive baseline data from the initial evaluation will be used in assessing changes in ocular status over time. Each follow-up examination will result in a new recommendation regarding fitness for continued flying duty. Work on this unit was formerly conducted under 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0028, NEW PSYCHOMETRIC NORMS

R.D. Wheatley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321720)

Psychometric results are individually meaningful only when compared to known standards for normal subjects or for groups

to which the individual is similar. Aircrew are a highly select and generally homogenous group and cannot be compared validly to the average population. The aircrew psychometric normative data in current use are now several years old and preliminary work indicates that today's aircrew may deviate significantly from the norms in current use. Additionally, several new psychological tests are now available which were not included in previous normative studies. The objective is to obtain test results of non-neuropsychiatric patients for a variety of psychological tests in use by the neuropsychiatric branch for evaluating aircrew. New standards will refine the definition of normal/abnormal performance in aircrew.

Subjects undergoing evaluation by the Aeromedical Consultation Service who are free of suspected/diagnosed neuropsychiatric disorders will routinely be administered the various psychological tests in current use by neuropsychiatry to establish standards for 'normal' subjects. Average ranges, means, etc., will be determined which later will be applied to the diagnosis, selection and retention of aircrew. Efforts were previously documented under 7755-04-14.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0029, DEVELOPMENT OF ACOUSTIC TEST APPARATUS FOR EVALUATION OF THE STATE OF THE HUMAN AIRWAYS

J.L. Patterson, Virginia Commonwealth University, Medical College of Virginia, Dept. of Medicine, *1200 E. Broad St., Richmond, Virginia* 23298 (NAS 1-16453)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

6.0030, INTEGRATED CUEING REQUIREMENTS STUDY

C. Kraft, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF228860; F33615-79-C-0014)

The objective of this effort is to develop a feasible methodology for the use of sensory/perceptual data in aircrew training device (ATD) design and evaluation. The final product of this effort shall be a comprehensive hard copy data base accompanied by and accessible through a preliminary design guide for training psychologists and simulation engineers.

A comprehensive data base which indexes catalogs, describes and defines the relationship among training requirements, cueing requirements, stimulus requirements, control inputs, piloting activities, and training device characteristics will be developed by means of an analytic literature review and empirical research in those areas where insufficient data has been previously collected. Experimentation shall be conducted using basic laboratory facilities as well as aircrew training devices. Major milestones are preliminary comprehensive study plan-3 MAC, final comprehensive study plan-14 MAC, end of phase I-14 MAC, end of contract-42 MAC (Tom Longridge is co-monitor).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0031, EFFECTS OF ANTI-G MEASURES ON GAS EXCHANGE

H.I. Modell, University of Washington, School of Medicine, Dept. of Physiology & Biophysics, *A-300 Health Sciences Ctr., SC-64, Seattle, Washington* 98195 (DF051920; F49620-78-C-0058)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiopulmonary responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Although information is available concerning physicological effects of moderated exposure to G (up to 5 G), little information is available at higher levels of G exposure such as might be experienced during aerial combat maneuvers flown in the F-15 and F-16 and next generation high performance aircraft. Deficiency - several questions remain to be answered relevant to high sustained G (HSG) tolerance if more effective protective measures are to be developed. This study will elucidate the extent to which commonly used protective measures (e.g., anti-G suits, straining manuevers) enhance or impair ventilation-perfusion ratios and the development of atelectasis at 1G and during exposure to HSG, the time course of gas exchange detriment resulting from use of these protective devices, the means by which these measures can be modified to optimize gas exchange during HSG. Objective - the overall objective of this research is to determine the extent to which commonly used anti-G measures enhance or impair gas exchange at 1 G and during exposure to HSG. How research contributes - the research will directly feed-in to on going exploratory development work conducted at USAFSAM and is covered under sub-area 1.5, 'Habitable Crew Environments in Air Force Operations.'

Animal experiments designed to examine changes in ventilation-perfusion distribution and atelectasis will be conducted at 1G in the University of Washington Laboratory and at HSG at USAFSAM. Protective measures to be examined include the anti-G suit abdominal bladder, positive pressure breathing, and the combined measures of anti-G suit abdominal bladder and positive pressure breathing. In addition to the experimental studies, the computer model of gas exchange (Modell and Hlastala, 1978) will be extended to included non-steady state pulmonary gas exchange and effects of anti-G protective measures on ventilation-perfusion distribution and gas exchange.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTER BASED METHODS FOR THERMODYNAMIC ANALYSIS OF MATERIALS PROCESSING

L. Kaufman, Manlabs Inc., *21 Erie St., Cambridge, Massachusetts* 02138 (DF057170; F49620-80-C-0020)

AF function - ceramic materials are being developed for a variety of components (e.g. blades, vanes, rotors, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Deficiency - the process of selecting the chemical composition and heat treatment of any material to obtain optimum properties has been a slow one based upon past experience and time consuming experimentation. Objective - over the past ten years, computer techniques have been developed for calculating the phase diagrams of dimple binary and selected ternary metal alloy systems. these techniques have recently been expanded to include several oxide, nitride, and carbide systems. The objective of this research is to develop techniques for using computer generated thermodynamic data in predicting stability of phases in experimental ceramic compositions. How work contributes - this work contributes to the selection of thermodynamically stable materials for AF communications and turbine applications.

The lattice stabiltiy, compound and solution phase interaction parameters will be evaluated to characterize the stable and meta-stable phased in selected glass and ceramic compositions. Thermochemical data will be estimated and evaluated from existing expermental phase diagrams where necessary. The thermodynamic considerations of the CVD doped germanium-borosilicated glasses appropriate to optical communication fibers will be evaluated as well as electro-optic III-V compounds and certain structural silicon based ceramics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, INTELLIGENT AUTOMATA

P. Winston, Massachusetts Inst. of Technology, Artificial Intelligence Lab., *545 Technology Sq., Cambridge, Massachusetts* 02139 (DN723357; N00014-80-C-0505)

The Navy has needs for advanced information systems designed to operate in an intelligent manner so as to assist managers in complex decision making situations. Information systems which perform these functions must have characterisics such as:

vision capability, ability to reason by analogy and learn from experience, natural language understanding and a general problem solving ability. Moreover, advanced software engineering concepts which are tailored to this situation are needed. The objective of this task is to do basic research in artificial intelligence and software construction, focusing on the above problems.

The approach is to build upon and make a logical continuation of previous research in computer language and vision, intelligent support systems, automated decision making, and software construction methodology specialized for artificial intelligence systems. Also computer hardware, especially designed for artificial intelligence systems, will be purchased and integrated into a distributed problem solving system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0003, IR STRATOSPHERIC EMISSION DATA

H. Sakai, University of Massachusetts, Amherst Campus, School of Natural Sciences & Mathematics, Dept. of Physics, *Amherst, Massachusetts* 01002 (DF582690; F19628-79-C-0062)

AF function - surveillance, target detection, discrimination and acquisition. Deficiency - lack of high-resolution spectral data of atmospheric background emission which reduces target to background contrast. Objective - perform data reduction and analysis of background atmospheric emission data as a function of altitude, time of day and season - data analysis which is needed for enhanced performance of present and future sensor systems used for target detection. How research contributes - the observation of background emission will provide a data base against which the hitran and lowtran calculations can be checked. Modifications to the atmospheric radiative modelling techniques can be improved from this data.

Special computor algorithms and software will be developed to perform the data analysis of a large amount of data to accomplish the objective as outlined above.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

7.0004, STABILITY AND DYNAMICS OF ELASTIC STRUCTURES AND FLUID FLOWS

M. Huerta, Miami University, School of Arts & Sciences, Dept. of Mathematics, *Oxford, Ohio* 45056 (DF053290; AFOSR-78-3663)

AF function - to design stable aerospace structures. Opportunity -a new mathematical approach to buckling in the presence of imperfections and to secondary buckling. Objective - aircraft structural design techniques are almost entirely based on linear elastic models. Present aircraft, however, operate in the nonlinear elastic regime with portions of the structure buckled or wrinkled. Improved nonlinear design techniques are being sought. How work contributes - original techniques for predicting catastrophic and secondary buckling and flutter.

Asymptotic techniques of stretching and matching yield non singular equations which extend bifurcation theory. This extended theory will be explored in the contexts of buckling with imperfections, secondary buckling, and nonlinear dynamic stability. Possible directions of research include extension of the theory to the more imperfection sensitive bifurcation points of high multiplicity, periodic and quasi periodic fluid structure interaction such as aircraft panel flutter, a statistical theory of bifurcation permitting direct determination of statistics, forced oscillation of nonlinear systems, and laminar flow transition to turbulence or chaos. Work on wave propagation in thin elastic structures, and nonlinear wave motion in air will be explored also by asymptotic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NUMERICAL ANALYSIS AND MACHINE COMPUTATIONS

P.J. Nikolai, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136330)

Computational algorithms are necessary for improved analysis and simulation of performance in the development complex weapons and delivery systems, but in many cases the algorithms are unavailable, and in others they are inadequate. The goal of this work is to develop practical, effective and efficient algorithms for the solution of numerical problems arising in typical computing tasks which occur repeatedly in different settings. Research is concerned with more accurate and efficient solution of the algebraic eigenvalue problem and the solution of large systems of linear algebraic equations, both basic computations in the analysis of loading of flight vehicle structures. This work leads naturally to wide-ranging consulting activities in regard to implementing computer algorithms, to efficient use of available computing resources and to procuring additional computing resources should this prove desirable.

The computational algorithms selected for analysis and implementation are determined by requirements arising within the task and by needs communicated through consulting activities within the laboratory as a whole. A given computational requirement may be satisfied by various competing methods. Algorithms arising from these methods are analyzed and evaluated for possible implementation as subroutines for available digital computers. These studies emphasize the extension of existing theory and the development of new algorithms when a realistic survey of existing methods reveals deficiencies either in performance or documentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0006, DIGITAL CORRELATION OF APQ-102A X-BAND RADAR IMAGERY, AND SAR SOFTWARE SUPPORT

C.R. Griffin, University of Texas, Austin Campus, School of Engineering, *200 W. 21st, Austin, Texas* 78712 (NAS 9-16208)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

7.0007, OPTIMAL AND INSENSITIVE CONTROL OF HYPERBOLIC DISTRIBUTED PARAMETER SYSTEMS WITH APPLICATIONS TO WING FLUTTER PROBLEMS

D.L. Russell, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Mathematics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF054020; AFOSR-79-0018)

AF function - the design of wing flutter suppression systems. Deficiency - there has been no optimal control policies developed to suppress wing flutter problems. Objective - the objective of this research is to explore new ideas in the areas of wing flutter suppression systems. How work contributes - success here would expand the lifetime of the aircraft inventory in addition to expanding the operating environment.

The investigation will begin in four unique but related areas. First, the model of wing flutter phenomenon will be refined to include actual aerodynamic and control forces typically affecting the wing structure in addition to the boundary conditions. Second, the linear quadratic optimal control methodology applied to linear hyperbolic systems will be studied to answer questions about the spatial smoothness properties of the feedback kernal in addition to the study of the Liapounov equation. Third, an extension of results on robustness and insensitivity to hyperbolic systems will be pursued. Finally, a control law must be based on a finite number of measurements and these must be based on a numerical solution of the system. A number of methods will be investigated to determine which method is well suited for this problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ATOMIC AND ELECTRONIC STRUCTURE OF DEFECTS IN SEMICONDUCTORS - 16885-MS

J.C. Spence, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (DA0G2540; DAAG29-80-C-0080)

To study the structure and electronic properties of defects in semiconductors. Relevance: The research is relevant to the improved understanding of semiconductor materials and solid state devices. This knowledge should lead to improved electronic materials.

Characterization of the structure of dislocations and stacking faults in Si, Ge, and III-V compounds using weak-beam, high resolution electron microscopy and lattice imaging. Computer simulation of images of the defects. Electrical characterization of defects using electron beam induced conductivity imaging and cathodilluminescence imaging in scanning transmission electron microscopy. Characterization of impurity point defects using electron energy loss spectroscopy. Correlation of structural, electrical, and point defect information.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0002, TIME-OF-FLIGHT MOLECULAR SPECTROSCOPY

W.E. Lamb, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DF039720; AFOSR-75-2864)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Opportunity - the search for new lasing media will be facilitated if potential energy diagrams of candidate molecules are known. Objective - to make velocity-resolved studies of the production of metastable atoms from dissociating molecules and their de-excitation by collisions with other atoms and molecules. Contribution - this research has the capability of establishing the potential energy diagrams of a number of diatomic molecules of interest to new lasers.

A time-of-flight spectrometer is being used to obtain high-resolution electron-bombardment dissociation spectra and collisional quenching cross section data for molecules of importance as reservoirs of potential energy which can be transferred to other lasing species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, INVESTIGATION OF ELECTRON ATTACHMENT PROCESSES IN POLYATOMIC MOLECULES

J.T. Dowell, International Research & Technology Corp., *P.O. Box 80817, San Diego, California* 92138 (DF047890; F49620-77-C-0071)

AF function - weapon system survivability, detection. Deficiency -there is presently insufficient knowledge of the complex interactions between electrons and molecules in a reentry vehicle flow field especially the mechanism and rates of electron attachment. Objective -investigation of the low energy electron attachment processes in polyatomic molecules with emphasis on the study of labile species produced in molecular beams. How work contributes - chemical processes leading to the production and removal of electrons in the re-entry vehicle wake are important in determing the plasma conductivity and in the consideration of the radar signature. This research seeks understanding and knowledge of electron removal processes by electrophilic molecules.

Conventional monoenergetic electron beam techniques are to be used for measurement of electron energy dependencies of attachment cross sections and of resonance, but a new method, incorporating a quadrupole electron trap, will be developed for determination of attachment rates as functions of temperature from 300K to 3000K. Species to be investigated include the metal oxyacids, beginning with tungstic acid. A study of the problem of electron bound states in the dipole fields of polar molecules will be initiated through measurements on the alkali halides. The mass spectrometric study of the WO3(s) & H2O reaction in the temperature range 1100K to 1600K will also serve as a check of the JANAF thermochemical data for H2WO4, WO3 and the polymers of WO3. The gas temperature dependence of the attachment will be studied separately from the electron energy dependence to assess the role of internal excitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, EPITAXIAL GROWTH OF Ge-GaAs

R.D. Fairman, Rockwell International Corp., *1049 Camios Dos Rios, P.O. Box 1085, Thousand Oaks, California* 91360 (DF044620; F44620-76-C-0134)

AF function - microwave solid state electronic devices are essential components of Air Force surveillance, electronic countermeasures, and communications systems. Opportunity - GaAs IMPATT diodes are limited in their efficiency due to the fact that the same material is used in both the avalanche and drift regions of the device. An improvement in efficiency is possible by using a narrow bandgap material for the avalanche zone and a high drift velocity material in the drift region. Objective - the objective of this research is to investigate and offer solutions to those epitaxial materials growth problems which have in the past precluded the synthesis of device quality Ge-GaAs heterojunctions and the rapid exploitation of this promising material for IMPATT type electron devices. How work contributes - a properly grown heterojunction of this type with Ge (narrow bandgap) and GaAs (high velocity) promises to produce IMPATT devices with efficiencies up to 25 percent greater than those of GaAs read-type IMPATTS.

The present work began as a fundamental study of the growth and materials problems encountered in the synthesis of Ge-GaAs heterojunctions by liquid phase epitaxy (LPE). One of the main problems with LPE growth of Ge-GaAs heterojunctions is autodoping due to substrate dissolution. LPE Ge layers have been grown on both semi-insulating and conducting GaAs substrates. But the autodoping problem was not solved satisfactorily and the Ge EPI layers did not meet expectations for the heterojunction application. Consequently, the LPE approach to this problem has been abandoned. A new approach to the problem has been employed since mid-1978 and involves a new (cold wall) heteroepitaxy technique, plasma enhanced CVD, one which has the potential of solving the autodoping problem, of lowering background contamination in the Ge epitaxy, and of synthesizing good doped junctions in the Ge epitaxy. It also offers advantage of an in situ approach (Ge VPE plus GaAs LPE), given the compatibility of the plasma and LPE reactors. EPI layers will be characterized by scanning electron microscopy, SIMS and C-V profiling and Hall mobility measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0005, ELECTRON SCATTERING BY LASER EXCITED ATOMS

S. Trajmar, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103 (PHY79-05971)

This project in atomic physics will study the scattering of electrons by atoms excited to specific states by a laser. A tunable dye laser will be used to populate individual hyperfine levels of specific isotopes and to prepare the target with known alignment and orientation (magnetic sublevel populations). Collision of nearly monoenergetic electrons with these excited species will be studied and the laboratory measurements will yield scattering amplitudes and relative phases as well as cross-sections for the various collision processes.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0006, SOLAR WIND PARAMETERS BEYOND L. A. U. AS SEEN BY PIONEER-10 AND -11

K.A. Anderson, University of California, Berkeley Campus, Graduate School, Dept. of Physics, *2200 University Ave., Berkeley, California* 94720 (NCC 2-105)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0007, BEVLAC S'HILAC NUCLEAR PHYSICS OPERATION

H. Grunder, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (4500-4520; W-7405-ENG-48)

The SuperHILAC and the Bevatron (BEVALAC) are operated as National Research Facilities for studies in nuclear physics, biophysics, nuclear chemistry, biomedical studies, and astrophysics. Ions from lithium to lead are accelerated to energies up to 8.5 MeV per nucleon at the SuperHILAC. Beams of two different ions can be produced on alternate pulses and delivered to one or two SuperHILAC experimenters plus the BEVALAC. At the BEVALAC, beams from hydrogen to iron are delivered to researchers at energies from approximately 70 MeV to 2.1 GeV per nucleon. Five major beam lines with 13 target areas designed for various studies are currently in operation at the SuperHILAC. At the Bevatron, experimenters are served by eight beam lines, with several specialized target areas. Outside users account for approximately half the research time at each accelerator. The Accelerator Research Coordination Office, augmented by a group of physicists, engineers, and support staff, is dedicated to assisting users, particularly those from other institutions, in successfully mounting their research. The SuperHILAC and Bevatron (BEVALAC) Users Associations communicate user concerns to accelerator operations staff, and also hold annual meetings to share research results and discuss future directions. The capability to deliver intense, very-high-mass beams is now being developed with the construction of the High Intensity Uranium Beams line item. When completed in FY 1982, the SuperHILAC will produce greater than or equal to 1 p mu A of all masses at up to 8.5 MeV/amu. The BEVALAC will be capable of delivering relativistic beams of all mass numbers including uranium, in addition to high-intensity intermediate-energy beams between 40 and 200 MeV/amu. Continual effort is given to improving the two accelerators, both in machine operation and experimental facilities, so that they remain relevant tools at the forefront of scientific investigation.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0008, EXPERIMENTAL AND THEORETICAL STUDY OF V-VI-VII COMPOUNDS

F.O. Wooten, University of California, Davis Campus, School of Letters & Science, Dept. of Physics, *Davis, California* 95616
(DF049470; AFOSR-77-3390)

AF function - microwave electronic devices are important elements of af communications and countermeasures systems. Opportunity -improved performance can be expected from the use of new solid state materials for the generation and detection of microwave signals. Present microwave solid state device performance is limited by the properties associated with the structure of the device material. Objective - the objective of this research program is to determine if the electronic band structure of V-VI-VII compounds exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport properties to ascertain their potential for utilization in solid state microwave amplifiers and generators. How work contributes -these compounds belong to a class of group V-VI-VII compounds that have a number of interesting physical properties possibly including negative charge carriers suggesting potential technological utility, especially for microwave devices. It is anticipated that these semiconductors have negative mass charge carriers.

This research investigates experimentally and theoretically the electronic band structure of the semiconductors BiSCl, BiSI, and BiSeI, as well as the bi thiohalides BiSBr, BiSeBr, and BiSeCl. The approach combines optically reflectance measurements with band structure calculations using the empirical pseudopotential method. This theoretical analysis expresses the atomic pseudopotential of each atom as a linear combination of two gaussians in real space. The potentials obtained from this approach are in real space and should be more convenient to check than potentials obtained in Fourier space.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0009, THEORETICAL STUDIES OF THE INTERFACE ELECTRONIC PROPERTIES OF TETRAHEDRALLY COORDINATED SEMICONDUCTORS

A. Madhukar, University of Southern California, Electronic Sciences Lab., *3551 University Ave., Los Angeles, California* 90007
(DN775385; N00014-77-C-0397)

As solid-state devices such as field-effect transistors, that are found in naval electronic systems, become more compact and more surface oriented in their electrical transport behavior, they begin to be dominated by surface and interface related effects. This program will seek to find better understanding of the electronic properties of interfaces formed between tetrahedrally coordinated semiconductors and of transport properties of inversion layers formed at a semiconductor-insulator interface.

Green's function techniques are applied to problem areas. In one case theoretical studies are made of the properties of solid-solid interfaces, the Schottky barrier and heterojunction problems. Tight binding Hamiltonians are used to calculate interface states and charge redistribution at interfaces, including the effects of short range electron-electron interactions. These techniques are now being extended to the case of superlattice structures in various binary III-V compound semiconductor systems. The other area of study is that of the electronic and transport properties of surface inversion layers. The major thrust is to consider both electron-electron and electron-phonon interactions in describing the experimental results of mass enhancement in Shubnikovdehaas and cyclotron resonance measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0010, ANGULAR-DEPENDENT ELECTRON SPECTROMETRY OF SURFACES

P.E. Best, University of Connecticut, Storrs Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Storrs, Connecticut* 06268
(DMR80-00022)

Experimental studies of the surface structures and electronic levels at semiconductor surfaces previously supported by DMR 76-80211A02 will be extended.

Angle-resolved electron energy loss and secondary emission measurements will be carried out for specified surfaces of the semiconductor gallium arsenide which is of importance in the electronics industry, and of the insulator barium oxide which is used in many devices that utilize thermionic emission. The dynamics of electrons in resonances on a silicon surface will be investigated using similar techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, LOW ENERGY INELASTIC ATOMIC AND MOLECULAR COLLISIONS - 16515-P

E. Pollack, University of Connecticut, Storrs Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Storrs, Connecticut* 06268
(DA0G9099; DAAG29-79-C-0125)

To study low energy atom-atom, ion-atom, ion-diatomic molecule collisions to understand the dynamics of excitation processes, obtain selection rules and scaling laws for both outer and inner shell processes. Relevance: The research has long range potential relevance to diverse fields including ion implantation and surface physics, laser plasma excitation mechanisms, some aspects of atmospheric modeling.

Inelastic energy loss (conversion of projectile energy into internal electronic excitation), observation of emitted photons and electrons in delayed coincidence, measurement of absolute differential elastic and inelastic cross sections, total optical and x-ray emission cross-sections, and measurement of polarization.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0012, OPERATION OF THE TANDEM-LINAC ACCELERATOR

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(56200; W-31-109-ENG-38)

This activity consists of the operation of the tandem-LINAC accelerator system so as to provide beams of nuclear projectiles for research in several areas of nuclear physics and occasionally in other areas of science. The accelerator system consists of a 9-MV tandem electrostatic accelerator and several sections of a superconducting-LINAC energy boost. During FY

1980 the linac provided a voltage boost of approximately 12 MV, and when it is finished in FY 1981 it will provide more than 20 MV. Because of the modular design of the booster, it can be effectively used to accelerator ion beams before it is completed. During FY 1980, the booster was operated about half of the time and the tandem alone is used during the other half. By mid-1981, the booster mode will be the dominant mode of operation.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0013, SEMICONDUCTOR OXIDE INTERFACE STATES
C.T. Sah, University of Illinois, Urbana Champaign Campus, Inst. of Aviation, *Willard Airport, Savoy, Illinois* 61874 (DF042160; AFOSR-78-3714)

AF function - Air Force communications, data processing, and remote sensing systems are among the many systems requiring reliable and stable solid state electronic components and devices. Deficiency - silicon is the dominant semiconducting material used in these devices, and the surface states, interface states, and oxide traps exert a controlling influence on the reliability as well as the electrical characteristics of bipolar and MOS field effect transistors. In addition, the two- and three-dimensional electrical properties of semiconductors are becoming increasingly important as the characteristic size in devices is reduced to submicron dimensions. Objective - the objective of this research is to obtain an understanding of the atomic origins and microscopic-macroscopic properties of the interface surfaces and oxide charges on semiconductor surfaces, as well as an understanding of two- and three-dimensional effects which become important at submicron device sizes. How work contributes - the objective will be accomplished by providing a combined experimental/theoretical approach.

Continue the studies of the atomic origin of the interface states and oxide charges in silicon MOS structures by means of - a) systematically varying the conditions of oxide charge generation during device fabrication as to oxidation ambient, temperature and subsequent anneal conditions and correlating these fabrication variations with evaluation of electrical properties, b) kinetic studies of such states and charges through their generation by UV light and keV electron beam excitation. A shared multiprogrammer interface between the electron-beam station and the UV light source set-up will be modified to duplicate interface set-up. A focussed electron beam (one micron size or less) on loan from industry will be installed. Small geometry effects and defects will be simulated as small device patterns by photoengraving in order to make extensive measurements with the electron-beam presently on hand. Mathematical analyses techniques will be developed to handle the two-and three-dimensional models more accurately than the partially lumped quasi three-dimensional model developed previously.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, NEUTRON SCATTERING
C.J. Stassis, Iowa State University of Science & Technology, U.S. Dept. of Energy Ames Lab., *University Station, Box 14A, Ames, Iowa* 50010 (W-7405-ENG-82)

Neutron scattering is a particularly powerful and versatile method for investigating the properties of materials. The research effort aims towards a fundamental understanding of those properties of materials which are central to emerging energy technologies. Particular emphasis is placed on the development of a microscopic understanding of phenomena which are basic to such problems as stability and strength of materials at high temperatures, superconductivity and hydrogen embrittlement. Neutron scattering may be used to determine phonon and magnon spectra, to investigate structural transformations, to determine magnetic structures, and to measure electronic distributions in solids. The current research effort encompasses investigations in several major areas: the electron--phonon interaction in solids and its relation to superconductivity, the lattice dynamics and structural transformation of solids at high temperatures, crystal structure and diffusion in metal--hydrogen systems, and the study of new materials developed by the materials preparation groups of the Ames Laboratory.

BIBLIOGRAPHIC REFERENCES: Stassis, C., et al, Lattice Dynamics of Gamma-Ce, Phys. Rev. B19: 5746 (1979). Stassis, C., et al, Field Induced Magnetic Form Factor of CeSn3, J. Appl. Phys. 50: 2091 (1979).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0015, COOPERATIVE PHENOMENA IN THE ELECTRICAL CONDUCTIVITY OF COMPOSITE MATERIALS
J.P. Straley, University of Kentucky, College of Arts & Sciences, Dept. of Physics & Astronomy, *Limestone & Euclid, Lexington, Kentucky* 40506 (DMR78-27023)

Research previously supported by DMR7611462. Near the percolation threshold of a random inhomogeneous conductor, the specific conductivity has a cooperative nature: the concentration dependence is asymptotically a power law, and the statistics of large clusters play a significant role. The theory of this system regarded as a cooperative phenomenon will be developed and applied to the following problems: A. networks of nonlinear elements (especially Josephson junctions), B. multifilamentary superconducting (Tsuei) wire, C. the resonance structure of networks containing positive and negative reactances, D. diffusion in random systems, E. the two-dimensional resistor network, and F. semiconductor powder layers. These problems will be treated by numerical modelling, position-space renormalization techniques, or analytical solution, as appropriate. An effort will be made to find relations between the conduction exponents and the percolation model exponents. A program will be written to solve very large resistor networks. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, HIGH TEMPERATURE PLASMAS (UNIV OF MD)
C.S. Liu, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN080362; N00014-80-C-0050)

Theoretical and numerical investigations are performed on the dynamics and stability of high temperature plasmas and charged particle beams. Areas of particular concern are the generation and manipulation of intense relativistic electron beams, intense ion beams, laser-plasma interaction and plasma spectroscopy.

This program involves theoretical studies of (a) the equilibrium, stability and transport properties of intense ion beams and relativistic electron beams, (b) nonlinear effects, as they pertain to microstability behavior and anomalous transport in high temperature plasmas, and (c) studies of radiation processes and atomic excitations by electron collisions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0017, FUNDAMENTALS OF MAGNETIC INTERACTIONS-NEW APPROACHES TO THEORY AND EXPERIMENT
A. Lempicki, General Telephone & Electronics Corp., G T E Laboratories Inc, *40 Sylvan Rd., Waltham, Massachusetts* 02154 (DF056180; F49620-79-C-0182)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, this is an extensive experimental and theoretical investigation directed at elucidating the fundamentals of magnetic interactions and light induced magnetic phase transitions. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts are needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of magnetic properties utilize model Hamiltonians, and model potentials which are incorrect on first principles considerations. Objective - the major emphasis will be on achieving a light-induced magnetic phase change and an ex-

tensive fundamental calculation aimed at a complete qualitative prediction of the mgnetic structure. Contribution - this research is part of a comprehensive program in statistical mechanics to study phase transitions.

The main goal of this research is a complete understanding of the nature of the coupling of the electronic spins, both orbital and intrinsic angular momenta, which give rise to the phenomena of cooperative magnetism. This does not exist at this time for any material. Light offers a sharp probe of magnetic interactions in certain magnetic semi-conductors, insulators and certain rare-earth metals that have magnetism highly sensitive to external influences. It can alter electronic spins directly, and alter populations of electronic states responsible for the coupling which is called opto-magnetism. It is proposed to combine a team of physicists, from industry and universities to obtain just the aforementioned understanding of magnetism.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0018, STUDY OF THE STRUCTURE AND DYNAMICS OF SIMPLE HYDROCARBONS ADSORBED ON GRAPHITE

H. Taub, University of Missouri, Columbia Campus, School of Arts & Sciences, Dept. of Physics, *130 Jesse Hall, Columbia, Missouri* 65201 (INT80-12228)

This award supports collaborative research in the field of surface structure studies, especially the determination of the orientation of an adsorbed molecule, i.e. the nature of the molecule-surface bond.

The work will center on the investigation of the structure and dynamics of some short-chain paraffin molecules will include: (1) neutron scattering experiments at the Missouri Research Reactor Facility (MURR) of the Department of Physics, University of Missouri-Columbia, and the Institut Laue Langevin (Ill) in Grenoble France; (2) low energy electron diffraction (LEED) and reflection high energy electron diffraction (RHEED) at the University of Marseilles, France and; (3) thermodynamic measurements at the Laboratoire Maurice Latort in Nancy, France.

The work is under the auspices of the U.S.-France Cooperative Science Program between the NSF and the CMRS (French National Center for Scientific Research.)

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0019, ANGULAR RESOLVED ELECTRON EMISSION STUDIES OF MICROWAVE MATERIALS

G.J. Lapeyre, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DF041290; F49620-77-C-0125)

AF function - modern aerospace electronic systems depend heavily upon solid state electronic and optical devices. Opportunity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitation processes in selected solids. Present solid state electronic and optical devices are based upon the properties of a relatively small percentage of the total number of materials potentially available. Objective - the objective of this research program is to provide knowledge on the electronic structure, electronic transitions and interaction, and optical properties for both the bulk and surface states of materials currently under investigation for microwave devices. How work contributes - it is anticipated that this research will provide knowledge which could lead to improvement in solid state devices that depend on surface effects such as the behavior of junctions and vapor films.

This research program experimentally investigates bulk and surface electronic and optical properties of III-V semiconductors, and single crystal metals using angular resolved, polarization dependent and other innovative photoemission techniques in the 2 to 125 eV photon range, Auger electron spectroscopy, low energy diffraction and energy band analysis. Angle-resolved measurements are used to obtain information on the moments as well as the energies of the bands in crystalline materials. The linear polarization of the synchrotron radiation will be used to infer symmetry properties of band states and localized stste and make it possible to exploit selection rules based on the symmetries. Study the physical properties of clean surfaces and interaction of adsorbates atoms and molecules with substrate surfaces. Chemisorption will emphasize the interaction of oxygen with semiconductor and metal surfaces at low temperatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, IMPROPER FERROELECTRICITY 16620-P

J.R. Hardy, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (DA0G0517; DAAG29-80-C-0034)

To understand the physics behind lattice instabilities which give rise to improper ferroelectric phenomena. Relevance: Improper ferroelectrics are prime candidates for pyroelectric solid state vidicons and imfrared imagers.

Utilizing theoretical calculations and light scattering measurements explore the properties of known improper ferroelectrics which have incommensurate phase transitions above the commensurate ferroelectric phase transitions in which the same lattice instability is responsible for both transitions. Systems under study will include the selenates, rubidium chloro-zincate, and bromo-zincate. Calculations designed to elucidate the balance between Coulomb and short-range forces responsible for the lattice instability will provide guidance to the experimental research that is undertaken.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0021, PASSIVATION OF GaAs SURFACES

C.J. Nuese, RCA Corp., RCA Laboratories, *Washington Rd., Princeton, New Jersey* 08540 (DF057920; F49620-80-C-0039)

AF function - surface recombination is a major cause for carrier loss and short lifetime in GaAs devices. Surface generation-recombination centers are attributed to surface states due to dangling bonds. This problem is common to all semiconductor devices where a surface terminates the continuity of a perfect crystal with a plane of dangling bonds. An opportunity now exists to determine if the hydrogenation of dangling bonds will improve GaAs devices with the success obtained for si devices. Objective-to develop the technology for a reliable inexpensive low temperature deposited passivant for 111-V compound surfaces.

The surface of GaAs will be treated with atomic hydrogen of various temperatures. The change in surface recombination will be monitored by measuring the change in luminescence before and after treatment. Any improvements due to the treatment can be iradicated by driving off the hydrogen by annealing. A-Si-H will be deposited on GaAs at various substrate temperatures. A DC-biased glow discharge decomposition system may be constructed to avoid bombardment damage. Deposition of hydrogenated GaAs by sputtering gaas in the presence of hydrogen will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, NMR STUDIES OF PHASE TRANSITIONS IN RARE GAS SUBMONOLAYERS

H.Y. Carr, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-23956)

Nuclear magnetic resonance (NMR) experiments will be carried out to observe density and temperature-dependent local magnetic fields in the gas-like and solid-like phases of rare gas sub-monolayers. In particular, the 2-dimensional 'liquid-vapor' and 'liquid-solid' phase transitions will be studied in these systems by observing the local-field discontinuities between phases. The rare gas will be adsorbed on graphite substrates. Other substrates will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, INTERACTION OF ELECTRONS AND IONS WITH PLASMA

M. Seidl, Stevens Inst. of Technology, Graduate School, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (PHY79-08555)

A study of the production and heating of volume plasmas by electron beams will be continued. The broad objective of the research is to explore the basic processes responsible for electron beam heating of plasmas confined in magnetic mirrors. The importance of the various interaction modes for transverse electron heating will be assessed. For this purpose the nonlinear evolution of the slow and fast cyclotron modes will be studied. The role of plasma and magnetic field inhomogeneities for transverse heating will be explored. Production of thin layers of dense plasmas on the surface of nonmetallic solids will be initiated. Three basic production methods will be explored: ohmic heating, electron bombardment, and ion bombardment. Ion emission from these surface plasmas will be studied. Particular attention will be paid to thermionic emission of alkali ions from zeolites and to secondary emission of negative hydrogen ions from surface plasmas produced by bombarding alkali hydrides with alkali ions.

This research is a continuation of that previously supported under NSF grant PHY-7707214A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, LASER LIGHT SCATTERING STUDIES OF SOLIDS

H.Z. Cummins, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. at 138th St., New York, New York* 10031 (DMR77-23788)

This research was previously supported by DMR-7412040.

The recently discovered dynamical central peak in potassium dihydrogen phosphate will be investigated using ultrahigh-resolution interferometry. Both the dynamic and static central peaks will be investigated in doped crystals and neutron irradiated crystals in order to establish the importance of impurities and defects to both central peaks. Additional experiments will be performed under hydrostatic stress in an effort to observe the theoretically predicted critical narrowing of the central peak.

Forbidden Raman scattering in cuprous oxide will be continued with the addition of uniaxial stress in order to elucidate the classification of the exciton series and of the interactions responsible for the unobserved excited-state resonances.

Resonance Brillouin, reflectance and luminescence studies of cadmium sulfide will be completed, and possible new experiments will be explored including the melting transition and superionic conductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, SINGLE ATOM INTERACTIONS AND SURFACE SEGREGATION OF DILUTE ALLOYS USING ATOM-PROBE AND FIELD ION MICROSCOPY

T.T. Tsong, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR79-04862)

The unique atomic resolution of the field ion microscope (FIM) will be used to investigate systematically the interaction between two atoms, both adatom-adatom and adatom-substitutional atom interactions, on group VIII and IB surfaces. The atomic interaction will be correlated with the electronic structures of adatoms and substrate surfaces, and the directional walk of single atoms under a controllable driving force will also be investigated. This information is not only of fundamental interest, but is also related to the surface reactivity. Since the unique catalytic activity of a surface arises partly from surface segregation of minority species in the alloy, the absolute composition depth profiles of near surface layers of dilute alloys will also be measured using the single atomic layer spatial resolution of the Time-of-Flight Atom-Probe FIM. The dependence of the composition of near surface layers on the bulk concentration of minority species, the sample temperature, and the crystal planes will be investigated, as well as the kinetics of reaching thermodynamic equilibrium. The alloys chosen for this study are nickel-copper, platinum-gold and platinum-copper since they are accessible to FIM study and they also offer various tests of the existing theories.

This research was previously supported by DMR 7815925. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, THEORY OF CONDENSED MATTER

J.H. Barrett, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (00039(18); W-7405-ENG-26)

The Solid State Division's program on theoretical solid state and materials science is carried out under this task. The principal investigators use the tools of modern solid state theory to conduct research in areas related to the mission of the Department of Energy. Close interactions with the experimentalists in the Division are maintained at all times. Frequently, the theorists are able to suggest interesting new experimental problems, new approaches to old problems, and methods for refining experimental techniques already in use; the theorists are consulted when new experimental programs are planned. The work relies heavily on the use of large computers in the application of existing theories and extensions of these theories to treat new problems as they arise. Entirely new theories are developed when needed. Currently, the research falls into the general areas of surface studies, lattice dynamics, electronic and magnetic problems, particle--solid interactions, laser annealing, and ultrarapid recrystallization phenomena. The theoretical methods used come from a variety of sources such as electronic band structure theory, multiple scattering theory, shell and Born-von Karman treatments of lattice dynamics, recent developments in the theory of disordered systems, quantum mechanical theories of electronic and magnetic susceptibilities, and Monte Carlo techniques.

BIBLIOGRAPHIC REFERENCES: Barrett, J.H., Potential and Stopping Power Information from Planar Channeling Oscillations, Phys. Rev. B 20: 3535 (1979).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

8.0027, THEORETICAL ATOMIC PHYSICS FOR FUSION

C. Bottcher, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (NOEWI(13); W-7405-ENG-26)

A detailed knowledge of the cross sections for many atomic processes such as charge exchange and ionization is essential to the logical development of magnetic fusion energy technology. It will be impossible to determine all the relevant cross sections experimentally, and many cross sections for known impurities in TOKAMAK are very poorly known. Methods of calculating a wide variety of cross sections must be developed. Thus, it is important that a theoretical program develop closely-coordinated with the experimental atomic cross section program and with the Fusion Energy Atomic Data Center here at ORNL. Further, very sophisticated laser diagnostic tools for plasma studies are being developed. A theory of coherent radiation is needed to interpret the results of these studies.

BIBLIOGRAPHIC REFERENCES: Bottcher, C., Energy Transfer in Ion-Polar Molecule Collisions, Chemical Physics Letters 66: 126-130 (1979); Bottcher, C., Exicted State Potential Surfaces and Their Applications, pp. 169-206 in Advances in Chemical Physics, Volume XLII, K. Lawley (ed.), John Wiley and Son, New York, 1980.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Fusion Energy

8.0028, ENERGY GAP STUDIES IN THIN FILM SUPERCONDUCTORS

B.J. Marshall, Texas Tech University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 4340, Lubbock, Texas* 79409 (D-170)

The interaction of surface acoustic waves with conduction electrons in thin film superconductors provides a method of determining the superconducting energy gaps in these thin films. A comparison of these energy gaps with the values previously obtained for the same materials in the bulk state provides one means of understanding the transition temperature enhancement in thin film superconductors.

The ultrasonic surface acoustic waves are generated by interdigital gratings plated onto both quartz and lithium niobate substrates. Thin films ranging from 100 A up to 10,000 A for Zn, Nb and Cd are presently being investigated. The material being studied is plated onto the substrate in the region between the sending and receiving interdigital gratings. This requires the surface wave to travel through the thin film resulting in energy being removed from the surface wave due to the electron-phonon interactions. By measuring the temperature dependence of this energy loss the superconducting energy gap can be calculated.

SUPPORTED BY Robert A. Welch Foundation

8.0029, CALCULATIONS OF SURFACE PROPERTIES OF CRYSTALS

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Research previously supported by DMR7518492.

A number of problems concerning the structure and the vibrational and related properties of surfaces of insulating crystals will be investigated. The aim is three-fold: (1) to continue the investigation of intrinsic phenomena of well-characterized simple idealized surfaces of molecular and ionic crystals; (2) to study the consequences of these intrinsic phenomena for surface experimental methods, such as infrared absorption, Raman and low-energy atom and ion scattering, and thermodynamic measurements; (3) to investigate the influence of surface structural and vibrational properties on the interaction with physisorbed 'foreign' atoms, and to study the properties of absorbate-absorbent systems.

Of great importance to these studies is the development of improved shell models for describing the ionic interactions in the bulk and near the surface, which will allow the simultaneous and consistent treatment of both structural and vibrational surface phenomena. The study and the implementation of those model interactions will be a central theme in the research.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, CRYSTAL GROWTH FROM VAPORS

F.E. Rosenberger, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR79-13183)

This research will be a fundamental study of the transport processes involved in crystal growth from vapors in closed cylindrical geometries. Emphasis will be on how compositional homogeneity and stability of growth depend on the (oscillatory) mass and heat transfer conditions in the vicinity of the solid-vapor interface. Supplementary theoretical (numerical) and experimental studies will determine transport (i.e. growth) rates in Physical and Chemical Vapor Transport systems as a function of ampoule geometry, orientation with reference to the gravity vector, temperature distribution and filling conditions.

Laser Doppler anemometry and differential interferometry will be used for vapor velocity measurements and flow visualization. Vapors and materials employed will be chemically characterized by matrix isolation, infrared and Raman spectroscopy, mass spectroscopy and atomic absorption spectroscopy. Transport rates will be studied by in-situ weighing with and electromicrobalance.

This is a continuation of research initiated under NSF Grant DMR75-03175-A01, and the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, EXTENDED X-RAY ABSORPTION FINE STRUCTURE

E.A. Stern, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-22955)

Extended X-ray absorption fine structure (EXAFS) will be used to obtain structural information in a variety of materials and the basic physical processes will also be studied. These experiments include the characterization of absorbates of substrates, the study of structural changes in amorphous materials, the study of charge density waves, and further investigations of anomalous results in some transition metal-halogen compounds.

This is a continuation of research previously supported under DMR73-02521. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, THEORY OF ANISOTROPIC MAGNETIC PROPERTIES AND ASSOCIATED LATTICE BEHAVIOR IN ACTINIDE AND RARE EARTH MATERIALS

B.R. Cooper, West Virginia University, School of Arts & Sciences, Dept. of Physics, *Morgantown, West Virginia* 26506 (DMR79-07069)

Research previously supported by DMR7706721.

Theoretical research will be carried out on the magnetic properties of actinide and rare earth materials. A major focus will be on cerium and actinide monopnictides of the sodium chloride structure. By introducing covalent interations between the conduction and the localized f-electrons, the remarkably anisotropic equilibrium and dynamic magnetic properties of these materials will be investigated. Secondly, a study of fluorite-structure oxides will examine important questions of correlation between magnetic behavior and lattice structural changes. Finally, other materials with related lattice and anisotropy effects will be studied. These will include praseodymium selenide, rare earth intermetallics and calcium or yttrium doped zirconia. Close coordination with experimental programs will be maintained.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, MAGNETIC AND DIELECTRIC PROPERTIES OF SOLIDS

M.S. Seehra, West Virginia University, School of Arts & Sciences, Dept. of Physics, *Morgantown, West Virginia* 26506 (DMR78-04397)

Three research projects will be carried out. First, an electron paramagnetic resonance study of the spin dynamics in the Heisenberg ferromagnet EuS near the Curie temperature will be done in order to test the predictions of the dipolar crossover behavior. Secondly, the magnet susceptibility of single crystals of MnO and CoO will be studied as a function of temperature, stress and crystal orientation. The role of mixed valences in the oxides is to be investigated. In the third project, the energy band gap delta E of iron pyrite (FeS2) will be determined by temperature-dependent transport measurements and optical absorption studies. Also, the effect of impurities and temperature on delta E is to be determined.

This is a renewal of DMR74-06684. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, COLLISIONAL EXCITATION AND RADIATION OF ATOMS AND MOLECULES
C.C. Lin, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF052870; AFOSR-78-3649)

AF function - RO 3.2, optical effects in communications, surveillance, navigation, and detection systems. Deficiency - any optical/infrared sensor system operating in or above the Earth's atmosphere must look through or against the background of atmospheric radiation. Objective - this research will elucidate the role played by collisional effects in atmospheric processes that generate background radiation. Contribution - further understanding of electron-induced atmospheric processes and in particular those processes producing optical and infrared emissions.

Basic research will be conducted on inelastic collision of electrons or negative ions with atoms and molecules and on the subsequent radiation from those atoms and molecules.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0035, SURFACE CRYSTALLOGRAPHY AND ELECTRONIC STRUCTURE OF METALS AND SEMICONDUCTORS
S.Y. Tong, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DMR77-28112)

Professor Tong is developing theories and calculational methods for extracting information on the geometric and electronic structures of surfaces from Low Energy Electron Diffraction (LEED) and from Angle Resolved Ultraviolet Photoemission Spectroscopy (ARUPS) data. Effective collaborations have been established with experimental laboratories that produce these data. For interpreting LEED data, Tong has developed two methods: the Combined Space Method permits accurate interpretation of LEED data for surfaces in which atoms are as much as 0.07 nm out of plane from one another; and, the Quasidynamical Method permits calculations of structures in which reconstruction (i.e., the surface structure is different from that of the bulk) extends by as much as 5 to 7 monolayers into the bulk. These methods are being extended and applied, for instance, to clean and arsenic-covered gallium arsenide, to different surfaces of silicon, and to hydrogen and larger molecules on metal surfaces.

For interpretation of ARUPS data, Tong and coworkers have developed the Multiple Scattering approach, which takes into account all of the factors that influence the angular distribution of the emitted electrons. Important among these processes is the multiple scattering of the low energy electron as it leaves the surface species. This method is being extended and applied to data for chalcogenide (oxygen, sulfur,....) atoms or small molecules on transition metal surfaces.

This is the first year of a three-year continuing grant. This is a continuation of research supported by DMR 73-02614.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PHOTOELECTRIC OBSERVATIONS OF LUNAR OCCULTATIONS
N.M. White, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST79-16150)

Photoelectric timings of occultations of stars by the Moon are an inexpensive way of providing basic data necessary to monitor changes in and improve the accuracy of the orbital elements of the Moon. The timings will enable the most accurate determination of the Moon's position relative to the stellar frame of reference. Photoelectric observations of 'shadow' diffraction pattern which sweeps across the surface of the Earth as the Moon passes in front of a star will provide the highest angular resolution yet obtained of multiple stellar system and diameters of stars cooler than the sun. This resolution is equivalent to measuring the diameter of a dime 1,000 miles away. These observations will provide basic data which bear directly upon fundamental astrophysical and cosmological questions. The full potential of this program is being realized by a continuing observational program over a number of years at several observing sites.

Prior support was by NSF grant AST 76-82248A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, VOYAGER MAPPING
H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeological Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-01973)

The Voyager spacecraft have returned more than 4,000 images of the Galilean satellites which prove them to be among the most fascinating bodies in the solar system. Shaded relief maps were prepared from these images that have been used as base materials for all scientific reports; preliminary versions of the maps will be published in January, 1980. Final versions of these maps, will be published in 1981, when control nets for the satellites have been finalized. A preliminary geologic map of Io was published in the August 30, 1979, issue of Nature magazine. Geologic maps of the other satellites are in progress and will appear in the Journal of Geophysical Research special Voyager issue.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0003, DESIGN STUDY FOR A SCANNING FACILITY FOR EARTH CROSSING ASTEROIDS
T. Gehrels, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NASW 3454)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0004, COORDINATED X-RAY, OPTICAL AND RADIO OBSERVATIONS OF AT MIC & AD LEO X-RAY EMISSION FROM RS CVN SYSTEMS (ABBREV)
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-373)

Coordinated X-ray, optical and radio observations of AT MIC & AD Leo X-ray emission from RS CVN systems: A follow-up study, an X-ray cluster in Aquila & high resolution imager study of the LMC.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0005, STELLAR ASTROPHYSICS
F.H. Shu, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST78-27594)

The research topics to be investigated involve important unresolved issues of mass and energy flow in stellar objects which are currently of great interest. Specific plans involve the following areas: A. Previous work on mass transfer in semi-detached binary stars will be extended to include the effects of non-synchronous spin of the mass-losing star, and to consider the structural response of the mass-receiving star after it has come into contact with its companion. B. The contact discontinuity model of the structure of contact binaries will be used to begin a study of their evolution on nuclear timescales. It is proposed to derive the shapes of W Ursae Majoris stars from an observational program of high resolution spectroscopy. C. Continuing theoretical work on protostellar evolution will be carried to a successful completion. Then an effort will be begun to calculate the observable consequences which can be compared with the many ongoing observational projects on young stars being carried out, including the active program at Berkeley under the direction of Leonard V. Kuhi.

In addition to these definite plans, new leads which appear during the course of the investigations will be pursued if they appear especially promising.

Prior support was by NSF grant AST 77-21643A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, INVESTIGATION OF IONIZATION EFFECTS IN THE STRATOSPHERE AT HIGH LATITUDES

J.R. Barcus, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-01183)

This grant will support an investigation of electrical conductivity and related quantities in the polar stratosphere. Previous research has been successful in obtaining baseline measurements by balloon-borne instrumentation over Greenland during a period near solar minimum. During that time, ionization in the middle and lower stratosphere was dominated by galactic cosmic rays. The results obtained, when taken together with relevant measurements of ionization and other electrical parameters, have helped to establish the state of polar stratospheric electricity during a time of relative geophysical calm. This program will concentrate on investigating stratospheric modifications produced at high latitude by transient sources of ionization (e.g., solar protons and nuclear gamma-rays, solar and auroral x-rays) expected to occur frequently near solar maximum. The total program continues to be a joint US/Danish effort involving the University of California (Berkeley), the Technical University of Denmark, and the University of Denver. The overall objective is to understand the electrodynamics of the polar middle atmosphere, especially as it relates to solar-terrestrial coupling.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0007, NSF PORTION OF VISITOR SUPPORT COSTS FOR THE IRTF

W.E. Brunk, U.S. National Aeronautics & Space Admin., Office of Space Science, Planetary Div., *Washington, District of Columbia* 20546 (AST80-07397)

This grant will support a portion of the costs incurred by visiting scientists conducting non-NASA interest research at the 3-meter Infrared Telescope Facility (IRTF), Mauna Kea, Hawaii. The IRTF is being operated as a nationally available facility for astronomical research by the University of Hawaii's Institute for Astronomy under an annually renewable contract which provides for complete NASA funding for all operating costs. This grant will provide for support of approximately 50% of the visitors using the Facility. An identical level of support will be provided by NASA. The support provided visitors will consist of: (1) reimbursement (less $100) of a principal investigator's roundtrip airfare to Hawaii, (2) payment of approximately two-thirds of the food and lodging costs for the entire observing team which will normally consist of three people, (3) payment of half of the costs of publishing the results of the research conducted on the IRTF, and (4) payment to the University of Hawaii for the administrative costs associated with the above system of visitor support.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, A SHUTTLE - SPACELAB INDUCED ATMOSPHERE EXPERIMENT

J. Weinberg, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32611 (NAS 5-26383)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0009, YERKES OBSERVATORY ASTROMETRIC PROGRAM

K.M. Cudworth, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (AST80-07275)

A part of the Yerkes Observatory astrometric program is devoted to the study of the proper motions of stars in open and globular clusters. These are important as indicators of the course of stellar evolution, as tracers of galactic structure, and as examples of dynamical systems in various states of relaxation. Their study also contributes to the calibration of the luminosities of various types of stars as well as to the distance scale in the Galaxy and the Universe. Measuring the relative proper motions of neighboring stars with the aim of determining cluster membership will be continued.

Another part of the Yerkes program is the determination of distances to stars in the solar neighborhood through measurements of the parallactic shift as the Earth circles the sun. Also, the development of observing, measuring, and reduction techniqes to substantially increase the accuracy of trigonometric parallaxes will be continued. Objects currently included in the program are red dwarf stars, white dwarf stars, and stars in the Hyades cluster. This last is done as part of an international campaign.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0010, THEORETICAL STUDIES OF THE STRUCTURE AND EVOLUTION AND CLOSE BINARY SYSTEMS

R.F. Webbink, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST78-12309)

Support is for theoretical research in the structure and evolution of close binary star systems. Continuing studies by the principal investigator address a broad range of topics involving binary stars: conditions of mass exchange between stars, and its effect on the evolution of both stars; the stability of many observed binary systems, especially novae and dwarf novae, against rapid mass exchange; and the role of close binaries in the evolution of star clusters and galaxies. Since most stars are members of close binary systems, solutions to these problems contribute to the understanding of stellar and galactic evolution. Emphasis will be placed on studies of the stability, nature and origin of the cataclysmic variable stars, and the evolution of binary stars to the cataclysmic binary stage.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, DEVELOPMENT OF A SPECTROSCOPIC METHOD FOR EXCITED MOLECULES PRODUCED BY ATOM RECOMBINATION ON SHUTTLE TILE COATINGS

D.A. Owen, Murray State University, School of Environmental Sciences, Dept. of Chemistry, *Murray, Kentucky* 42071 (NAS 9-16254)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

10.0012, FAINT PHOTOELECTRIC PHOTOMETRIC STANDARD STAR SEQUENCES

A.U. Landolt, Louisiana State University, Agricultural & Mechanical College, School of Science, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (DF047270; AFOSR-77-3218)

AF function - reconnaissance and surveillance of spacecraft. Deficiency - present standard star sequences are too bright and saturate the telescope-detector data collection system, making it impossible to calibrate the acquired data. Objective - to establish photometric standards for stars in magnitude inter-

val 10 to 17 and for a wide color extending from a wavelength of 3500 angstroms to 9000 angstroms. Contribution - sequences of faint standard stars will permit the calibration of detector in space object identification systems.

The observations at Cerro Tololo Inter-American Observatory in Serena, Chile of 7th to 9th magnitude stars will be completed at the 0.4 meter telescope. The observations of 10th to 12th magnitude stars is half completed and will continue on the 0.9 meter telescope using the 0.4 meter observations as standard stars. Bootstrapping of the 0.9 meter observations to the 1.5 meter telescope will be undertaken for the 13th to 15th magnitude range. Time on the 4 meter telescope has been assigned to begin to create standard stars of the 16th to 17.5 magnitude. Photographic observations at the 1.0 meter telescope will be devoted to experimentation with the racine prism in calibrating stellar brightness and color down to the photographic plate limits. Testing of the two-star photometer will continue. This photometer will be used initially to study a variety of variable stellar objects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0013, SUPPORT OF THE MILLSTONE HILL INCOHERENT SCATTER RADAR DURING SOLAR MAXIMUM CONDITIONS

J.V. Evans, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (ATM79-09189)

The Millstone Hill Incoherent Scatter radar has recently been considerably upgraded for studies of the ionosphere and upper atmosphere at auroral and subauroral latitudes through the addition of a full-steerable 150' antenna moved to the site (with support from the National Science Foundation). The new antenna permits almost the entire auroral convection pattern (60 degrees is less than A which is less than 75 degrees) to be observed in one day, and efforts to exploit these results in studies of the relationship of the convection pattern to the interplanetary solar magnetic field, the field-aligned current into the polar cap, the formation of the nighttime trough, and the variation of the electron densities, electron and ion temperatures at auroral and subauroral latitudes. These measurements form part of the U.S. program for the International Magnetosphere Study. They are being coordinated with observations at the other incoherent scatter radars, with balloon, whistler and aircraft observations over Canada and/or satellite observations. Other uses for the new antenna include studies of the electrodynamic coupling between the E- and F-regions through tidal generated polarization electric fields, the latitudinal variation (Hough functions) of tides propagating into the lower thermosphere, and for special events - such as the recent eclipse over Canada, or rocket launches from Wallops Island. The period funded under this grant includes the end of the observing phase of the International Magnetosphere Study and the commencement of a follow-on phase of data reduction and continuing observations during the maximum of the current solar cycle (expected to peak in 1981). This grant provides funds for operation of this facility.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0014, A MEASUREMENT OF THE METRIC ANGULAR DIAMETER-REDSHIFT RELATION FOR GALAXIES

D.J. Hegyi, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (DF057610; AFOSR-80-0095)

AF function - detection and surveillance of spacecraft. Deficiency - images fainter than about one percent of the ambient background are difficult to detect using vidicons, image intensifiers or photographic techniques. Objective - to measure the angular diameter of faint extended astronomical objects by using a charge-coupled device to perform picture processing in real time at the telescope. Contribution - this research on the angular diameter of galaxies will develop techniques to extract the maximum amount of information from a faint image and to detect images in a low contrast situation.

Observations of the angular diameter of galaxies will be carried out with a charge-coupled device, a minicomputer and a microprocessor. The observing plan has three phases. The first ten brightest elliptical galaxies in nearby clusters will be observed to establish the surface brightness distribution to high accuracy. Similar data will be obtained at moderate redshifts in order to learn whether evolutionary effects within a cluster are significant. The observations then will be carried out to the greatest distance from which redshifts can be obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0015, STUDY OF GEOLOGICAL MATERIALS BY THE METHODS OF PARTICLE TRACKS, THERMOLUMINESCENCE AND RARE GASES

R.M. Walker, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (EAR78-22440)

This is a continuation of research supported under NSF grant EAR76-22697 and A01.

A continuing search for superheavy elements is proposed using low-level spontaneous fission counting experiments on plastic track detectors. The samples to be used in these experiments will be separated fractions of the Allende meteorite and hot springs extracts obtained from Russia. The anomalous fission events in these samples may indicate the presence of superheavy elements.

The discovery of large numbers of meteorites in Antarctica opens up an exciting new chapter in meteoritics. These meteorites give the first opportunity to look at the behavior of cosmic rays at discrete intervals of time in the past. Also these meteorites make it possible to determine if the nature of the meteorite flux hitting the earth has changed in time. The time factors in various age determinations will be measured using the radiation damage (fossil track technique in films) and measurements of radioisotopes such as 26Al and 53Mn, etc.

Thermoluminescence measurements will be made routinely as a method of measuring terrestrial ages and delineating those meteorites with unusual orbital elements.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

10.0016, STUDIES OF THE DYNAMICS OF ELLIPTICAL GALAXIES

M. Schwarzschild, Princeton University, Graduate School, Dept. of Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST78-23796)

Elliptical Galaxies have long been considered as giant stellar systems, each rotating around its axis and having a symmetrical figure around this axis (such as oblate spheroids). In recent years, however, observational and theoretical indications have been uncovered which suggest that this earlier picture may be an oversimplification and that the true figures of Elliptical Galaxies may be significantly more complicated (such as tri-axial elipsoids). The question then arises whether tri-axial stellar systems can exist in long-lasting dynamical equilibrium, a necessary condition for models of Elliptical Galaxies. It is here proposed to approach this question numerically, but not by N-body calculations. In contrast to this latter approach, tri-axial configuration appropriate for an Elliptical Galaxy is chosen from the outset. Next, the gravitational force exerted by this configuration on any star within it is derived. Third, stellar orbits following this force are computed, one at a time, in contrast with N-body computations. Finally, according to the proposed plan, each orbit is statistically occupied by a certain number of stars such that all the stars on all the orbits together reproduce the configuration chosen at the outset. If this last step succeeds in as conclusive a manner as can be hoped for from a numerical approach (in contrast to a basic mathematical approach, if feasible), then tri-axial configurations would appear likely better models for the majority of Elliptical Galaxies than the earlier axially symmetrical ones and new questions regarding their mode of origin would arise.

This is a continuation of AST-7522924A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0017, IDENTIFICATION AND PHOTOMETRY OF QUASI-STELLAR OBJECTS IN SELECTED HIGH-LATITUDE FIELDS

P.D. Usher, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (AST78-21498)

The criterion of ultraviolet and infrared color excess and optical variability will be used to identify candidate quasi-stellar objects (QSOs) brighter than R approximately 20 magnitude in 10 Kapteyn Selected Areas at high galactic latitude. Variability and red or infrared excess will be used to separate QSOs from white dwarfs. The Selected Areas are centered on smaller faint-limit fields currently under investigation by Sandage. The research will supplement the faint-limit fields and provide further information toward problems of the isotropy and the spatial density of QSOs.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0018, OBSERVATIONS OF BINARY AND PROPER-MOTION STARS

W.D. Heintz, Swarthmore College, Graduate School, Dept. of Astronomy, *Swarthmore, Pennsylvania* 19081 (AST79-06379)

Visual observations by micrometer, spectroscopic, and photographic measurements jointly assist in revealing the properties of binary and multiple stars and of nearby dwarf stars. Principal goals are: Improvement and increase of data on orbital motions, periods, and masses in binary systems; search for undiscovered binary stars, or additional components in known binaries; study of the apparently low incidence of binaries among faint red stars, and study of small proper-motion errors in connection with the problem of the apparently low incidence of nonluminous companions.

The 61 cm refractor at Swarthmore College is the principal instrument used by the Investigator with the micrometer, to about 12 or 15% of telescope time. Additional micrometer work and other observations are planned at Kitt Peak and Cerro Tololo Observatories.

Prior support was under NSF grant AST 77-12236.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0019, THEORETICAL RESEARCH ON PLANETARY ATMOSPHERES

J.W. Chamberlain, Rice University, Wiess School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (ATM80-06530)

The grant funds research in the areas of: (1) Planetary exospheres and atmospheric escape of hydrogen atoms, with emphasis on the radiation pressure from solar Lyman-alpha emission and its effect on the balance of charge-exchange reactions between H and the 'hot' H plasmasphere. (2) Radiative transfer in planetary atmospheres, with emphasis on the ultraviolet markings on Venus and the vertical cloud structure of Saturn. (3) Atmospheric dynamics, with emphasis on an understanding of the cloud motions on Jupiter as revealed by Voyager spacecraft.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0020, THE EVOLUTION OF STARS IN METAL DEFICIENT SYSTEMS AND RELATED PROBLEMS IN OTHER STARS

R.T. Rood, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (AST76-23170 A01)

This research will involve studies of the structure of stars in galactic globular clusters and dwarf spheroidal galaxies. There will be an analysis of the effect of abundance anomalies on the stars of galactic globular clusters and dwarf spheroidal galaxies which are extremely deficient in their heavy element abundances. An attempt will be made to find improved ways of connecting theoretical calculations and observational data in these systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, OPERATION OF THE TECHNOLOGY APPLICATION CENTER AT THE UNIV OF NEW MEXICO

S.A. Morain, University of New Mexico, School of Arts & Sciences, Dept. of Geography, *University Hill N.E., Albuquerque, New Mexico* 87106 (NASW 3408)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space & Terrestrial
Applications

11.0002, THE INDENTIFICATION OF A PRACTICABLE LEGAL REGIME FOR THE CARRIAGE OF GOODS AND PERSONS TO, FROM AND WITHIN OUTER SPACE

H. DeSaussure, University of Akron, School of Law, *Akron, Ohio* 44325 (NCA 2-5101)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

11.0003, SUMMER RESEARCH FELLOWSHIP PROGRAM

G.C. Darden, Hampton Inst., Graduate School, Dept. of Mathematics, *Hampton, Virginia* 23368 (NAS 1-16455)

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N81-19000* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 130
Jan. 1981 95 p
(NASA-SP-7037(130)) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 01A

This bibliography lists 282 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in December 1980. Author

N81-19001*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED AERODYNAMICS AND ACTIVE CONTROLS, SELECTED NASA RESEARCH
Feb. 1981 180 p refs Presented at the 4th Ann. Status Rev. of the NASA Aircraft Energy Efficiency (ACEE) Energy Efficient Transport Program, Mountain View, Calif. 7-9 Oct. 1980
(NASA-CP-2172; L-14278) Avail: NTIS HC A09/MF A01 CSCL 01B

Aerodynamic and active control concepts for application to commercial transport aircraft are discussed. Selected topics include in flight direct strike lightning research, triply redundant digital fly by wire control systems, tail configurations, winglets, and the drones for aerodynamic and structural testing (DAST) program. For individual titles, see N81-19002 through N81-19013.

N81-19002*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY RESEARCH CENTER CONTRIBUTIONS IN ADVANCING ACTIVE CONTROL TECHNOLOGY c08
I. Abel and J. R. Newsom *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 1-19 refs (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

The application of active control technology to reduce aeroelastic response of aircraft structures offers a potential for significant payoffs in terms of aerodynamic efficiency and weight savings. Some of the contributions of the Langley Research Center in advancing active control technology are described. Contributions are categorized into the development of appropriate analysis tools, control law synthesis methodology, and experimental investigations aimed at verifying both analysis and synthesis methodology. E.D.K.

N81-19003*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS AND FUTURE PLANS OF THE DRONES FOR AERODYNAMIC AND STRUCTURAL TESTING (DAST) PROGRAM c05
Harold N. Murrow *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 21-36 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

Results from flight tests of the ARW-1 research wing are presented. Preliminary loads data and experiences with the active control system for flutter suppression are included along with comparative results of test and prediction for the flutter boundary of the supercritical research wing and on performance of the flutter suppression system. The status of the ARW-2 research wing is given. E.D.K.

N81-19004*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSPORT AIRCRAFT FLYING QUALITIES ACTIVITIES c05
Martin T. Moul *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 37-42 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

The optimal control model for pilot vehicle systems was used to develop a methodology for predicting pilot ratings for commercial transports. The method was tested by applying it to a family of transport configurations for which subjective pilot ratings were obtained. Specific attention is given to the development of the simulator program and procedures so as to yield objective and subjective performance data useful for a critical evaluation of the analytical method. E.D.K.

N81-19005*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IN FLIGHT DIRECT STRIKE LIGHTNING RESEARCH c03
Felix L. Pitts *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 43-65 refs (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

The lightning generated electromagnetic environment effecting aircraft is studied. The program uses F-106B aircraft which operates in a thunderstorm environment and is specially instrumented for the lightning electromagnetic measurements. The instrumentation system is reviewed and typical results recorded by the research instrumentation during simulated lightning ground tests performed for a safety survey are presented along with several examples of direct strike data obtained during the summer of 1980. E.D.K.

N81-19006*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
GROUND AND FLIGHT TEST EXPERIENCE WITH A TRIPLE REDUNDANT DIGITAL FLY BY WIRE CONTROL SYSTEM c08
Calvin R. Jarvis and Kenneth J. Szalai *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 67-84 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

A triplex digital fly by wire flight control system was developed and installed in an F-8C aircraft to provide fail operative, full authority control. Hardware and software redundancy management techniques were designed to detect and identify failures in the

system. Control functions typical of those projected for future actively controlled vehicles were implemented. E.D.K.

N81-19007*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SMALL TRANSPORT AIRCRAFT TECHNOLOGY c05

Thomas L. Galloway *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 85-104 refs (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 01C

The results of contracted studies identifying the potential benefits of advanced technology are presented. Current in house studies and research efforts are discussed. An overview of the proposed technology elements in STAT research is presented. E.D.K.

N81-19008*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

INVESTIGATION OF POWERED NACELLES ON A HIGH ASPECT RATIO NASA SUPERCRITICAL WING, PHASE 2 Status Report c05

Stuart G. Flechner, James C. Patterson, Jr., and Paul G. Fournier *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 105-122 (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 01C

A modified wing with the long core separate flow nacelle and several E(3) nacelles was utilized. The effects of nacelle and pylon cant angles and nacelle longitudinal and vertical location were investigated over a Mach number range from 0.70 to 0.83. The results at the cruise condition 0.82 Mach number and 0.55 lift coefficient are presented. E.D.K.

N81-19009*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE EET HORIZONTAL TAILS INVESTIGATION AND THE EET LATERAL CONTROLS INVESTIGATION Status Report c08

Peter F. Jacobs and Dennis W. Bartlett *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 123-133 (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 01C

In the energy efficient transport (EET) Horizontal Tails Investigation, aerodynamic data were measured for five different horizontal tails on a full span model with a wide body fuselage. Three of the horizontal tails were low tail configurations and two were T tail configurations. All tails were tested in conjunction with two wings, a current wide body wing and a high aspect ratio supercritical wing. Local downwash angles and dynamic pressures in the vicinity of the tails were measured using a yaw head rake. The results provide a comparison of the aerodynamic characteristics of the two wing configurations at trimmed conditions for Mach numbers between 0.60 and 0.90. In the EET Lateral Controls Investigation, the control effectiveness of a conventional set of lateral controls was measured over a Mach number range from 0.60 to 0.90 on a high aspect ratio supercritical wing semispan model. The conventional controls included a high speed aileron, a low speed aileron, and six spoiler segments. The wing was designed so that the last 25% of the chord is removable to facilitate testing of various control systems. The current status and an indication of the data obtained in these investigations are presented. E.D.K.

N81-19010*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

NATURAL LAMINAR FLOW FLIGHT EXPERIMENT c02

Louis L. Steers *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 135-144 (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 01A

A supercritical airfoil section was designed with favorable pressure gradients on both the upper and lower surfaces. Wind tunnel tests were conducted in the Langley 8 Foot Transonic Pressure Tunnel. The outer wing panels of the F-111 TACT airplane were modified to incorporate partial span test gloves having the natural laminar, flow profile. Instrumentation was installed to provide surface pressure data as well as to determine transition location and boundary layer characteristics. The flight experiment encompassed 19 flights conducted with and without transition fixed at several locations for wing leading edge sweep angles which varied from 10 to 26 at Mach numbers from 0.80 to 0.85 and altitudes of 7620 meters and 9144 meters. Preliminary results indicate that a large portion of the test chord experienced laminar flow. E.D.K.

N81-19011*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

KC-135 WINGLET FLIGHT RESULTS c05

Lawrence C. Montoya *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 145-156 (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 01C

Three KC-135 winglet configurations were flight tested for cant/incidence angles of 15 deg/-4 deg, 15 deg/-2 deg, and 0 deg/-4 deg, as well as the basic wing. The flight results for the 15 deg/-4 deg and basic wing configurations confirm the wind tunnel predicted 7% incremental decrease in total drag at cruise conditions. The 15 deg/-4 configuration flight measured wing and winglet pressure distributions, loads, stability and control, flutter, and buffet also correlate well with predicted values. The only unexpected flight results as compared with analytical predictions is a flutter speed decrease for the 0 deg/-4 deg configuration. The 15 deg/-2 deg configuration results show essentially the same incremental drag reduction as the 15 deg/-4 deg configuration; however, the flight loads are approximately 30% higher for the 15 deg/-2 deg configuration. The drag data for the 0 deg/-4 deg configuration show only a flight drag reduction. E.D.K.

N81-19012*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OVERVIEW OF ADVANCED WING DESIGN c05

Raymond M. Hicks *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 157-169 ref (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 01C

Examples of experiment theory correlation are presented to give an indication of the capabilities and limitations of wing design and analysis for transonic applications by potential flow theory. The examples include correlations of experimental pressure distributions with theoretical results from isolated wing codes and wing-body codes. Both conservative and non conservative differencing as well as body and boundary layer corrections are considered. A full potential isolated wing code correlates well with data from an isolated wing test but may give poor prediction of the aerodynamic characteristics of some wing-body configurations. Potential flow wing body codes were found to improve the correlation for the wing-body configurations considered. E.D.K.

N81-19013*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ADVANCED TURBOPROP INSTALLATION AERODYNAMICS c07

R. C. Smith *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 171-181 refs (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 21E

The expected aerodynamic effects of a propfan installed on a thick supercritical wing are summarized qualitatively. Nacelle/wing and jet interactions, slipstream incremental velocity, nonuniform inflow, and swirl loss recovery are discussed. E.D.K.

N81-19014*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLIGHT INVESTIGATION OF A FOUR-DIMENSIONAL TERMINAL AREA GUIDANCE SYSTEM FOR STOL AIRCRAFT

Frank Neuman and Gordon Hardy Mar. 1981 43 p refs (NASA-TM-81271; A-8491) Avail: NTIS HC A03/MF A01 CSCL 17G

A series of flight tests and fast-time simulations were conducted, using the augmentor wing jet STOL research aircraft and the STOLAND 4D-RNAV system to add to the growing data base of 4D-RNAV system performance capabilities. To obtain statistically meaningful data a limited amount of flight data were supplemented by a statistically significant amount of data obtained

from fast-time simulation. The results of these tests are reported. Included are comparisons of the 4D-RNAV estimated winds with actual winds encountered in flight, as well as data on along-track navigation and guidance errors, and time-of-arrival errors at the final approach waypoint. In addition, a slight improvement of the STOLAND 4D-RNAV system is proposed and demonstrated, using the fast-time simulation. T.M.

N81-19015# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

APPLICATION OF SCHEDULING HEURISTICS ON THE AIRCRAFT MAINTENANCE DEPOT M.S. Thesis

Joseph William Adams, Jr. Dec. 1980 54 p refs
(AD-A094815; AFIT/GOR/OS/80D-1) Avail: NTIS HC A04/MF A01 CSCL 12/2

Scheduling heuristics were applied to a model of the aircraft maintenence depot at Warner Robins Air Logistics Center. Since the C-141 aircraft was being overloaded into depot, heuristics which gave the C-141 priority were tested in an effort to reduce the mean and variance of the distribution of times the C-141 aircraft spent at the depot. One heuristic was found which reduced the average depot time by 4%. The significance of this decrease was calculated to be 91%. A similar heuristic reduced the variance by 81%, with a significance of 100%. Thus, the potential exists for improving the flow of the overloaded C-141 aircraft through the depot, using scheduling heuristics. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-19016*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LEADING EDGE VORTEX FLAPS FOR DRAG REDUCTION Patent Application

Dhanvada M. Rao, inventor (to NASA) (Old Dominion Univ.) Filed 26 Nov. 1980 12 p Sponsored by NASA
(NASA-Case-LAR-12750-1; US-Patent-Appl-SN-210491) Avail: NTIS HC A02/MF A01 CSCL 01A

A leading edge flap system to control the coiled vortex formation on highly swept slender wings designed for supersonic flight is disclosed. The vortex flap is positioned forward of, and at an angle downward from, the leading edge of the wings. It is retracted beneath the wings during supersonic flight. Flow separation occurs on the highly deflected vortex flap creating a coiled vortex on the vortex flap surface. The suction of the coiled vortex produces an aerodynamic thrust component. The pitch up and lateral stability problem associated with coiled vortex formation on the wing surface are reduced. Segmented flaps with independent adjustment allow optimum flow conditions to be closely approximated. NASA

N81-19017*# McDonnell Aircraft Co., St. Louis, Mo. Aerodynamics Dept.

INVESTIGATION OF IMPINGEMENT REGION AND WALL JETS FORMED BY THE INTERACTION OF HIGH ASPECT RATIO LIFT JETS AND A GROUND PLANE Final Report, 19 Sep. 1977 - 19 Sep. 1978

Donald R. Kotansky and Lloyd W. Glaze 19 Sep. 1978 93 p refs
(Contract NAS2-9646)
(NASA-CR-152174) Avail: NTIS HC A05/MF A01 CSCL 01A

Flow characteristics of impinging jets emanating from rectangular exit area converging nozzles of exit area aspect ratio four, six, and eight were investigated. Azimuthal distributions of wall jet radial momentum flux in the ground plane were strongly directional and sensitive to rectangular nozzle exit area aspect ratio, jet impingement angle, and height above ground, H/D. Effects of jet exit velocity profile nonuniformities were also investigated. Data from the single nozzle rectangular jet impringement investigations were incorporated into an existing VTOL aircraft ground flow field computer program. It is suggested that this program together with the Douglas Neumann program modified for V/STOL applications may be used for the analysis and prediction of flow fields and resulting forces and moments on multijet V/STOL aircraft hovering in ground effect. E.A.K.

N81-19018*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

THEORETICAL ANALYSIS OF AN AUGMENTOR WING FOR A VTOL FIGHTER Final Report, May 1977 - Dec. 1978

Marnix F. E. Dillenius and Michael R. Mendenhall May 1979 53 p refs Sponsored in part by Navy
(Contract NAS2-9605)
(NASA-CR-152254; NEAR-TR-183) Avail: NTIS HC A04/MF A01 CSCL 01A

A method based on potential flow theory was developed for predicting forces and moments acting on augmentor wings for prescribed ejector jet characteristics. A three dimensional nonplanar vortex lattice is laid out on the chordal planes of the augmentor wing components. Jet induced effects are included in the boundary condition from which the horseshoe vortex strengths are obtained. The jet within the diffusor is made to expand from the primary nozzles to the diffusor exit and is represented by a distribution of vorticity on the jet boundary to provide proper entrainment. The jet downstream of the diffusor exit is modeled by a vorticity distribution and blockage panels and its centerline location and spreading rate are taken from experimental data. The vortex lattice and jet models are used in an iterative manner until the predicted diffusor exit velocity matches the specified one. Some comparisons with available data show good agreement at lower power settings. Author

N81-19019*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AEROPROPULSIVE CHARACTERISTICS OF TWIN NONAXISYMMETRIC VECTORING NOZZLES INSTALLED WITH FORWARD-SWEPT AND AFT-SWEPT WINGS

Francis J. Capone Mar. 1981 260 p
(NASA-TP-1778; L-13902) Avail: NTIS HC A12/MF A01 CSCL 01A

An investigation was conducted in the Langley 16 Foot Transonic Tunnel to determine the aeropropulsive characteristics of a single expansion ramp nozzle (SERN) and a two dimensional convergent divergent nozzle (2-D C-D) installed with both an aft swept and a forward swept wing. The SERN was tested in both an upright and an inverted position. The effects of thrust vectoring at nozzle vector angles from -5 deg to 20 deg were studied. This investigation was conducted at Mach numbers from 0.40 to 1.20 and angles of attack from -2.0 deg to 16 deg. Nozzle pressure ratio was varied from 1.0 (jet off) to about 9.0. Reynolds number based on the wing mean geometric chord varied from about 3 million to 4.8 million, depending upon free stream number. E.D.K.

N81-19020*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UNSTEADY TRANSONIC SMALL DISTURBANCE THEORY WITH STRONG SHOCK WAVES

G. David Kerlick, David Nixon, and William F. Ballhaus, Jr. Sep. 1980 22 p refs
(NASA Order A-70215-B; NASA Order A-77455-B)
(NASA-CR-166157; NEAR-TR-230) Avail: NTIS HC A02/MF A01 CSCL 01A

A theory to correct the transonic small disturbance (TSD) equation to treat strong shock waves in unsteady flow is developed. The technique involves the addition of higher order terms, which are formally of negligible magnitude, to the low frequency TSD equation. These terms are then chosen such that any shock waves in the flow have strengths approximately equal to the appropriate Rankine-Hugoniot shock strength. Two correcting approaches are investigated. The first is to derive a correction for the mean steady flow and then simply use this corrected form for oscillatory flows. The second is to derive a correction for both steady and oscillatory parts of the flow. This second development is the most satisfactory and comparisons of the present results with Euler equation results are generally favorable, particularly regarding shock location, although there are some

discrepancies in the pressure distribution in the leading edge region. M.G.

N81-19021*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.

A THEORETICAL INVESTIGATION OF GROUND EFFECTS ON USB CONFIGURATIONS

C. Edward Lan Jan. 1979 134 p refs
(Grant NsG-1139)
(NASA-CR-159005; CRINC-FRL-281-3) Avail: NTIS HC A07/MF A01 CSCL 01A

A formulation predicts the variation of circulation forces and jet reaction forces in ground proximity as a function of ground height. The predicted results agree well with available experimental data. It is shown that the wing-alone theory is not capable of predicting the ground effect for USB configurations. T.M.

N81-19022*# Boeing Commercial Airplane Co., Seattle, Wash.

A HIGHER ORDER PANEL METHOD FOR LINEARIZED SUPERSONIC FLOW

F. Edward Ehlers, Michael A. Epton, Forrester T. Johnson, Alfred E. Magnus, and Paul E. Rubbert May 1979 268 p refs
(Contract NAS2-7729)
(NASA-CR-3062; D6-48058) Avail: NTIS HC A12/MF A01 CSCL 01A

The basic integral equations of linearized supersonic theory for an advanced supersonic panel method are derived. Methods using only linear varying source strength over each panel or only quadratic doublet strength over each panel gave good agreement with analytic solutions over cones and zero thickness cambered wings. For three dimensional bodies and wings of general shape, combined source and doublet panels with interior boundary conditions to eliminate the internal perturbations lead to a stable method providing good agreement experiment. A panel system with all edges contiguous resulted from dividing the basic four point non-planar panel into eight trangular subpanels, and the doublet strength was made continuous at all edges by a quadratic distribution over each subpanel. Superinclined panels were developed and tested on a simple nacelle and on an airplane model having engine inlets, with excellent results.
Author

N81-19023*# Wichita State Univ., Kans.

PRESSURE DISTRIBUTIONS FOR THE GA(W)-2 AIRFOIL WITH 20% AILERON, 25% SLOTTED FLAP AND 30% FOWLER FLAP

W. H. Wentz, Jr. and K. A. Fiscko Feb. 1978 86 p refs
(Grant NsG-1165)
(NASA-CR-2948; AR-76-3) Avail: NTIS HC A05/MF A01 CSCL 01A

Surface pressure distributions were measured for the 13% thick GA(W)-2 airfoil section fitted with 20% aileron, 25% slotted flap and 30% Fowler flap. All tests were conducted at a Reynolds number of 2.2 x 10 to the 6th power and a Mach number of 0.13. Pressure distribution and force and moment coefficient measurements are compared with theoretical results for a number of cases. Agreement between theory and experiment is generally good for low angles of attack and small flap deflections. For high angles and large flap deflections where regions of separation are present, the theory is inadequate. Theoretical drag predictions are poor for all flap-extended cases. Author

N81-19024*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECT OF WING-TRANSITION LOCATION AND SLOTTED AND UNSLOTTED FLAPS ON AERODYNAMIC CHARACTERISTICS OF A FIGHTER MODEL AT HIGH SUBSONIC SPEEDS

Theodore G. Ayers Sep. 1969 46 p refs
(NASA-TM-X-1849; L-6613) Avail: NTIS HC A03/MF A01 CSCL 01A

An investigation was conducted in the Langley 8 foot transonic pressure tunnel to determine the effects of wing transition location and of slotted and unslotted full span flaps on the longitudinal aerodynamic characteristics of a 1/15 scale model of a variable wing sweep tactical fighter model. Tests were at Mach numbers from 0.70 to 0.85 for a wing leading edge sweep of 26 deg.
T.M.

N81-19025*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 0.25 TO 1.01 OF A TRANSPORT CONFIGURATION DESIGNED TO CRUISE AT NEAR-SONIC SPEEDS

Richard A. Langhans and Stuart G. Flechner Aug. 1972 108 p refs
(NASA-TM-X-2622; L-8226) Avail: NTIS HC A06/MF A01 CSCL 01A

The results of the investigation showed that the configuration exhibits a sufficiently high drag divergence Mach number to cruise at near sonic speeds. The configuration is longitudinally stable through the cruise Mach number and lift coefficient range, but at higher lift coefficients displays pitchup and becomes unstable. The configuration was directionally stable at all test conditions and laterally stable in the angle of attack range required for cruise. T.M.

N81-19026*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF THE VORTEX CONDITIONS OF WINGS WITH LARGE SWEEPBACK BY EXTRAPOLATION OF THE JONES METHOD

P. Hirsch Dec. 1980 24 p Transl. into ENGLISH from "Essai d'etude du regime tourbillonnaire des ailes de forte fleche par extrapolation de la methode de Jones", Lille, Paper NT80-25, 1979 22 p Presented at the 16th Symp. of Appl. Aerodynamics, Lille, France, 13-15 Nov. 1979 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75863) Avail: NTIS HC A02/MF A01 CSCL 01A

The pockets of separation originating on the leading edges are surrounded by vortex sheets. Their configuration and intensity were determined by four conditions with the JONES approximation, which is itself corrected by a simple logic. Field pressures and stresses were computed for different cases and are compared with test results (pure deltas, swallow tails, truncations, strakes, ducks, fuselage). T.M.

N81-19027*# National Aeronautics and Space Administration, Washington, D. C.

SEPARATION BEHAVIOR OF BOUNDARY LAYERS ON THREE-DIMENSIONAL WINGS

H. W. Stock Feb. 1981 76 p refs Transl. into ENGLISH of "Ablooseverhalten von Grenzchicten an Dreidemensionalen Fluegeln" Final Rept. 79/71B Friedrichshafen, West Germany, Oct. 1979 86 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Dornier-Werke G.m.b.H., Friedrichshafen, West Germany
(Contract NASw-3199)
(NASA-TM-75877) Avail: NTIS HC A05/MF A01 CSCL 01A

An inverse boundary layer procedure for calculating separated, turbulent boundary layers at infinitely long, crabbing wing was developed. The procedure was developed for calculating three dimensional, incompressible turbulent boundary layers was expanded to adiabatic, compressible flows. Example calculations with transsonic wings were made including viscose effects. In this case an approximated calculation method described for areas of separated, turbulent boundary layers, permitting calculation of this displacement thickness. The laminar boundary layer development was calculated with inclined ellipsoids. R.C.T.

N81-19028# Aeronautical Research Labs., Melbourne (Australia).

AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF TRAILING-EDGE STRIPS ON THE UNSTEADY AERODYNAMIC FORCES ON TABS

G. Long and P. A. Farrell Mar. 1980 37 p refs
(AD-A094989; ARL/STRUC/NOTE-459; AR-001-808) Avail: NTIS HC A03/MF A01 CSCL 01/3

A fairly common problem on new aircraft is that of achieving good control surface effectiveness. Often boundary layer thickness and interference from other surfaces may cause flow separation on all or part of the control. This reduces control efficiency and can cause serious problems in achieving good control of aircraft response. These types of problems are difficult to predict analytically or from wind-tunnel tests. Usually the first evidence

of such difficulties occurs during prototype flying and consequently serious efforts must be made to find a 'fix' which can be introduced fairly simply and cheaply at a late stage in the design. These 'fixes' often involve vortex generators, placed on or ahead of the control, or thickening of the trailing edge of the control. The latter may be simply achieved by attaching a small angle to one or both sides to the control along the trailing edge. The aim of these and other methods is to improve the effectiveness of the control and hopefully to increase this to its theoretical or design value. While the effect of such modifications is fairly well known for steady flow, little evidence is available of the effect in unsteady flow. There are no theoretical methods of predicting unsteady aerodynamic forces on oscillating control surfaces which have vortex generators or trailing-edge angles. Usually complete reliance is based on classical thin lifting surface theories for predicting flutter speeds and frequencies. The work described was undertaken as a result of an accident to the Nomad aircraft in which flutter occurred as a result of fitting trailing-edge strips to the tailplane tabs. GRA

N81-19029# Air Force Academy, Colo. Dept. of Aeronautics.
MEASUREMENT OF CANARD WAKES Final Report, 1 Oct. 1979 - 30 Sep. 1980
G. Sisson, R. Crandall, and R. W. Gallington 2 Feb. 1981 52 p refs
(AD-A095063; USAFA-TN-81-1; USAFA-TR-80-17) Avail: NTIS HC A04/MF A01 CSCL 20/4

This technical note consists of two separate papers. The first covers the manufacture and calibration of miniature seven hole probes. The second paper covers the flow field data collection and presentation. Together, the two papers describe the entire process developed to quickly and economically measure the flow field properties in canard model wakes. The first paper describes a method for measuring local direction and total and static pressures of a flow by means of a fixed probe, provided that the local air flow does not make an angle of more than 80 degrees with the axis of the probe. Rapid surveys of the wakes formed behind variously-configured lifting body models during wind tunnel testing require such a probe. The probe is easily manufactured from standard-sized tubing materials. The power series calibration method used with the probe results in explicit polynomial expressions for the desired aerodynamic properties. The calibration method is easily programmed on a data acquisition system. This paper includes an example of a complete incompressible calibration and discusses a logical method for extending the calibration technique to compressible flows. GRA

N81-19030# Nielsen Engineering and Research, Inc., Mountain View, Calif.
EXPERIMENTAL AND THEORETICAL STUDY OF FLOW FIELDS AND STORE FORCES IN CLOSE PROXIMITY TO A TRIPLE EJECTION RACK AT TRANSONIC SPEEDS Final Report, Jun. 1979 - Jun. 1980
Frederick K. Goodwin and Jack N. Nielsen China Lake, Calif. Naval Weapons Center Sep. 1980 248 p refs
(Contract N60530-79-C-0169; ZF32300000)
(AD-A094751; AD-E900055; NEAR-TR-222; NWC-TP-6210) Avail: NTIS HC A07/MF A01 CSCL 01/1

Systematic data were taken in an airplane build-up sequence including additions of the wing pylon, rack, one shoulder store and two shoulder stores from M infinity equals 0.6 to 0.95. Strong interference effects were found within less than one store diameter of the rack which greatly affected the values of the attached loads. Systematic comparisons were made between experimental and the predictions of a store separation computer program for induced flow fields and store loads due to addition of the pylon, rack, and shoulder stores. For the effects of the rack and shoulder stores improvements are required in the computer program to obtain better load predictions for the store near the attached position. Specific suggestions on how to effect these improvements are made. GRA

N81-19031# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CALCULATION OF AIRLOADS FOR A FLEXIBLE WING VIA NASTRAN M.S. Thesis
Lance Eliot Chrisinger Dec. 1980 78 p refs
(AD-A094770; AFIT/GAE/AA/80D-2) Avail: NTIS HC A05/MF A01 CSCL 20/4

This thesis describes the use of the NASTRAN program (Level 17.0) in the calculation of flexible wing airloads and stresses. The problems of interfacing aerodynamic and structural models are discussed with assumptions needed to solve them. Two different methods of transferring the aerodynamic forces into a structural load vector are presented. A Direct Matrix Abstraction Program was developed for use in these calculations. This sequence is limited to the use of one doublet-lattice panel for the aerodynamic model and requires several new data blocks for execution. Although these data blocks were input with the bulk data deck to test the sequence, a new preliminary module has been constructed to build them internally. The results of this investigation show that NASTRAN can be used in calculating the airloads and stresses for a flexible wing. This new sequence has extended the capability of NASTRAN to allow for the application of internally generated steady airloads to the structural model. GRA

N81-19032# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A HIGHER-ORDER TRAPEZOIDAL VECTOR VORTEX PANEL FOR SUBSONIC FLOW M.S. Thesis
Ronald E. Luther Dec. 1980 95 p refs
(AD-A094775; AFIT/GAE/AA/80D-14) Avail: NTIS HC A05/MF A01 CSCL 20/4

A higher-order trapezoidal vector vortex panel method is developed for application to linearized subsonic potential flow. Each panel is subdivided into two triangular subregions on which a quadratic vorticity strength distribution is prescribed for both the spanwise and chordwise components of the vorticity vector. The vorticity strength distribution is expressed as a function of the components of the vorticity vector at selected nodes of the boundary of each triangular subregion. Nodal values on the shared boundary of the subregions are made equal, assuring continuity of the vorticity distribution function throughout the trapezoidal panel. A lifting surface of no thickness is modeled with a network of the trapezoidal panels. Again, nodal values on the common panel boundaries are matched to achieve complete continuity of the vorticity distribution throughout the lifting surface. Aerodynamic data for several wing planforms is obtained with the flow model. Results from this method are compared to those from other computational and theoretical methods. GRA

N81-19033# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INTERACTIVE COMPUTATIONAL AERODYNAMICS ANALYSIS PROGRAM M.S. Thesis
Enrique G. Hernandez Dec. 1980 248 p refs
(AD-A094765; AFIT/GAE/AA/80D-9) Avail: NTIS HC A11/MF A01 CSCL 01/1

This report details how existing aerodynamic analysis programs were combined and integrated into a fully interactive analysis program. The resulting program has several levels of user assistance, complete error protection, and protection against fatal terminations. The program was built around an aerodynamics analysis code which is capable of predicting the real fluid sectional characteristics of airfoils in flows with subcritical Mach numbers. In addition to the viscous flow solution, the program is also capable of several airfoil modification functions. The program was developed as the basic building block upon which several other aerodynamics analysis codes will be added in the future. GRA

N81-19034# European Space Agency, Paris (France).
CONTRIBUTION TO THE STUDY OF SUPERSONIC LAMINAR SEPARATION: UTILIZATION AND IMPROVEMENTS IN INTEGRAL METHODS OF CALCULATION Ph.D. Thesis
Gilles About Dec. 1980 110 p refs Transl. into ENGLISH of "Contrib. a l'Etude du Decollement Supersonique Laminaire: Mise en Oeuvre et Perfectionnements des Methodes de Calculs Integrales", ONERA, Paris, Rept. ONERA-NT-1980-1, 1980 Original report in FRENCH previously announced as N80-31363 (ESA-TT-662; ONERA-NT-1980-1) Avail: NTIS HC A06/MF A01

The calculation of the phenomena associated with supersonic laminar separation was studied by coupling the solution of the equations of the ideal fluid and the boundary layer equations expressed in integral form. The definition of similar profiles was approximated by a simple analytic representation and the implementation of a second order boundary layer formulation. Le Balleur's numerical calculation method was adapted to laminar flows, and applied to the study of separation and reattachment on a compression ramp or due to a shock wave reflection. Some three parameter velocity profiles are determined which are able to take account of the effects of the laminar sub layer, which are then used in a three moment integral method. Author (ESA)

N81-19010*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
NATURAL LAMINAR FLOW FLIGHT EXPERIMENT
Louis L. Steers *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 135-144 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N81-19035*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE 1980 AIRCRAFT SAFETY AND OPERATING PROBLEMS, PART 1
Joseph W. Stickle, comp. Mar. 1981 380 p refs Conf. held in Hampton, Va., 5-7 Nov. 1980 2 Vol.
(NASA-CP-2170-Pt-1; L-14254) Avail: NTIS HC A17/MF A01 CSCL 01C

It is difficult to categorize aircraft operating problems, human factors and safety. Much of NASA's research involves all three and considers the important inter-relationships between man, the machine and the environment, whether the environment be man-made or natural. Topics covered in 20 papers include terminal-area operations; avionics and human factors; and the atmospheric environment. For individual titles, see N81-19036 through N81-19055.

N81-19036*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TEST RESULTS OF FLIGHT GUIDANCE FOR FUEL CONSERVATIVE DESCENTS IN A TIME-BASED METERED AIR TRAFFIC ENVIRONMENT
Charles E. Knox and Lee H. Person, Jr. *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 7-27 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The NASA developed, implemented, and flight tested a flight management algorithm, designed to improve the accuracy of delivering an airplane in a fuel-conservative manner to a metering fix at a time designated by air traffic control. This algorithm provides a 3D path with time control (4D) for the TCV B-737 airplane to make an idle-thrust, clean configured (landing gear up, flaps zero, and speed brakes retracted) descent to arrive at the metering fix at a predetermined time, altitude, and airspeed. The descent path is calculated for a constant Mach/airspeed schedule from linear approximations of airplane performance with considerations given for gross weight, wind, and nonstandard pressure and temperature effects. The flight management descent algorithms are described and flight test results are presented.
A.R.H.

N81-19037*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PILOT'S SUBJECTIVE ANALYSIS OF A COCKPIT DISPLAY OF TRAFFIC INFORMATION (CDTI)
Gerald L. Keyser, Jr. *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 29-49 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Both the advent of electronic displays for cockpit applications and the availability of high-capacity data transmission systems, linking aircraft with ATC ground computers, offer the opportunity of expanding the pilots' role in the distributive management process. A critical element in this process is believed to be the presentation to the pilot of his traffic situation. A representative cockpit display of traffic information (CDTI) system is presented as viewed from the pilot in the cockpit, and the research results from flight tests presented. The use of advanced controls and displays allows for presentation to the pilot, large quantities of information that he has not had before. The real challenge in the design of an operational CDTI system will be the satisfaction of needs for information and the presentation of all necessary information, only in a useable format in order to avoid clutter. Even though a reasonably large display was utilized in these tests, display clutter was the primary problem from the standpoint of information assimilation.
A.R.H.

N81-19038*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GUIDANCE AND CONTROL SYSTEM RESEARCH FOR IMPROVED TERMINAL AREA OPERATIONS
R. M. Hueschen, J. F. Creedon, W. T. Bundick, and J. C. Young *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 51-81 refs Prepared in cooperation with Information and Control Systems, Inc., Hampton, Va., Boeing Co., Seattle, Wash., and Analytical Mechanics Associates, Inc., Hampton, Va. (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Several guidance and control system research and development activities aimed at improving the operational capabilities of commercial aircraft in the terminal area are described. The guidance and control systems were designed to improve the capacity and efficiency of terminal area operations, enhance the approach and landing capability of aircraft in adverse weather conditions, and reduce the impact of aircraft noise perceived on the ground. Specific performance features include the ability to capture and track steep glideslopes, use short final approaches, perform flares with reduced longitudinal touchdown dispersion and execute high speed runway rollout and turnoff. Results obtained from simulation studies or flight tests are shown for each of the algorithms.
Author

N81-19039*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPERATIONAL CONSIDERATIONS IN UTILIZATION OF MICROWAVE LANDING SYSTEM APPROACH AND LANDING GUIDANCE
William F. White and Leonard V. Clark *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 83-112 (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The characteristics and performance of MLS equipment utilized by the TCV B-737. Several classes of MLS service and approach procedures are discussed in light of TCV experience. Since the early uses of MLS involves procedures identical to ILS, most of the discussion is concerned with exploitation of MLS capabilities not possessed by ILS. Examples are given of how this could be done by using MLS to enhance the safety and utility of procedures presently in use for noise abatement. Some areas which require definition of new procedures and conventions are indicated.
Author

N81-19040*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
AUTOMATED PILOT ADVISORY SYSTEM TEST AND EVALUATION AT MANASSAS MUNICIPAL AIRPORT
John L. Parks, Jr. *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 113-125 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

In cooperation with the Federal Aviation Administration, NASA developed an experimental automated pilot advisory system (APAS) to provide airport and air traffic advisories at high density uncontrolled airports. The APAS concept is to utilize low cost

automated systems to provide the necessary information for pilots to more safely plan and execute approach and landing at uncontrolled high density airports. The system is designed to be a natural extension of the procedural visual flight rules system used at uncontrolled airports and, as an advisory system, will enhance the 'see-and-be-seen' rule and an evaluation of the APAS concept was obtained from pilots who used the system at the Manassas, Virginia airport. These evaluations and the system performance are presented. A.R.H.

N81-19041*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A METHOD FOR DETERMINING LANDING RUNWAY LENGTH FOR A STOL AIRCRAFT

D. M. Watson, G. H. Hardy, J. F. Moran, and D. N. Warner, Jr. *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 127-144 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Based on data obtained from flight tests of the augmentor wing jet STOL research aircraft, a method is proposed for determining the length of the landing runway for powered-lift STOL aircraft. The suggested method determines runway landing length by summing three segments: the touchdown-dispersion distance, the transition distance from touchdown to application of brakes, and the stopping distance after brakes are applied. It is shown how the landing field length can be reduced either through improved autoland system design or by providing the pilot with appropriate information to allow him to identify a 'low probability' long or short landing and to execute a go-around. The proposed method appears to determine a safe runway landing length for the STOL application and offers the potential for reducing runway length if great emphasis is placed on a short-runway capability. FAR Parts 25 and 121 appear conservative and suitable for the situation where no great emphasis is placed on reducing the runway length requirement. A.R.H.

N81-19042*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLIGHT TESTS OF IFR LANDING APPROACH SYSTEMS FOR HELICOPTERS

J. S. Bull, D. M. Hegarty, L. L. Peach, J. D. Phillips, D. J. Anderson, D. C. Dugan, and V. L. Ross *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 145-164 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Joint NASA/FAA helicopter flight tests were conducted to investigate airborne radar approaches (ARA) and microwave landing system (MLS) approaches. Flight-test results were utilized to prove NASA with a data base to be used as a performance measure for advanced guidance and navigation concepts, and to provide FAA with data for establishment of TERPS criteria. The first flight-test investigation consisted of helicopter IFR approaches to offshore oil rigs in the Gulf of Mexico, using weather/mapping radar, operational pilots, and a Bell 212 helicopter. The second flight-test investigation consisted of IFR MLS approaches at Crows Landing (near Ames Research Center), with a Bell UH-1H helicopter, using NASA, FAA, and operational industry pilots. Tests are described and results discussed. A.R.H.

N81-19043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A HEAD-UP DISPLAY FORMAT FOR TRANSPORT AIRCRAFT APPROACH AND LANDING

Richard S. Bray and Barry C. Scott (FAA) *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 165-193 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

An electronic flight-guidance display format was designed for use in evaluations of the collimated head-up display concept applied to transport aircraft landing. In the design process of iterative evaluation and modification, some general principles, or guidelines, applicable to electronic flight displays were suggested. The usefulness of an indication of instantaneous inertial flightpath was clearly demonstrated. Evaluator pilot acceptance of the unfamiliar display concepts was very positive when careful attention was given to indoctrination and training. Author

N81-19044*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN EVALUATION OF HEAD-UP DISPLAYS IN CIVIL TRANSPORT OPERATIONS

John K. Lauber, Richard S. Bray, and Barry C. Scott (FAA) *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 197-199 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

To determine the advantages and disadvantages of head-up displays (HUD) in civil transport approach and landing operations, an operational evaluation was conducted on the flight simulator for advanced aircraft at Ames. A non-conformal HUD concept which contained raw data and Flight Director command information, and a conformal, flight path HUD concept was designed to permit terminal area maneuvering, intercept, final approach, flare, and landing operations. Twelve B-727 line pilots (Captains) flew a series of precision and non-precision approaches under a variety of environmental and operational conditions, including wind shear, turbulence and low ceilings and visibilities. A preliminary comparison of various system and pilot performance measures as a function of display type (Flight Director HUD, Flight Path HUD, or No HUD) indicates improvements in precision and accuracy of aircraft flight path control when using the HUDs. The results also demonstrated some potentially unique advantages of a flight path HUD during non-precision approaches. A.R.H.

N81-19045*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GENERAL AVIATION SINGLE PILOT IFR AUTOPILOT STUDY

Hugh P. Bergeron *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 201-217 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Five levels of autopilot complexity were flown in a single engine instrument flight rules (IFR) simulation for several different IFR terminal operations. A comparison was made of the five levels of complexity ranging from no-autopilot to a fully coupled lateral and vertical guidance mode to determine the relative benefits vs. complexity/cost of state of the art autopilot capability in the IFR terminal area. Of the five levels tested, the heading select mode made the largest relative difference in decreasing workload and simplifying the approach task. It was also found that the largest number of blunders was detected with the most highly automated mode. The data also showed that, regardless of the autopilot mode, performance during an IFR approach was highly dependent on the type of approach being flown. These results indicate that automation can be useful when making IFR approaches in a high workload environment, but also that some disturbing trends are associated with some of the higher levels of automation found in state of the art autopilots. M.G.

N81-19046*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

APPLICATION OF THE EPIDEMIOLOGICAL MODEL IN STUDYING HUMAN ERROR IN AVIATION

Ed S. Cheaney (Battelle Columbus Labs., Mountain View, Calif.) and Charles E. Billings *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 219-236 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

An epidemiological model is described in conjunction with the analytical process through which aviation occurrence reports are composed into the events and factors pertinent to it. The model represents a process in which disease, emanating from environmental conditions, manifests itself in symptoms that may lead to fatal illness, recoverable illness, or no illness depending on individual circumstances of patient vulnerability, preventive actions, and intervention. In the aviation system the analogy of the disease process is the predilection for error of human participants. This arises from factors in the operating or physical environment and results in errors of commission or omission that, again depending on the individual circumstances, may lead

to accidents, system perturbations, or harmless corrections. A discussion of the previous investigations, each of which manifests the application of the epidemiological method, exemplifies its use and effectiveness. M.G.

N81-19047*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HOW A PILOT LOOKS AT ALTITUDE
Amos A. Spady, Jr. and Randall L. Harris, Sr. *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 237-248 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Commerical pilot eye scanning data previously collected were reanalyzed to evaluate how pilot used the drum pointer altimeter. The results of these tests showed that the pilots seldom used the drum window apparently because it was difficult to read as indicated by average drum window dwell times of .6 seconds. It is suggested that pilot scanning data be collected for other type of altimeters in order to find those with good scanning characteristics. M.G.

N81-19048*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUMMARY OF FLIGHT TESTS OF AN AIRBORNE LIGHTING LOCATOR SYSTEM AND COMPARISON WITH GROUND-BASED MEASUREMENTS OF PRECIPITATION AND TURBULENCE
Bruce D. Fisher and Norman L. Crabill *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 251-277 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Data from an airborne lightning locator system and data relating to storm intensity obtained by ground-based Doppler radars and the S-band research radar are presented. When comparing lightning locations from the airborne lightning locator system with ground-based Doppler radar measurements of reflectivity and spectrum width, the lightning locations tended to be further from the aircraft position than the Doppler radar contours, but at the same relative bearing from the aircraft as the Doppler contours. The results also show that convective storms generate little or no lightning for a significant part of their life cycle, but can produce at least moderate turbulence. Therefore, it is concluded that a lack of lightning activity cannot be accepted as an inference of a corresponding lack of other hazards to the flight of aircraft through convective storms. M.G.

N81-19049*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
WALLOPS SEVERE STORMS MEASUREMENT CAPABILITY
Robert E. Carr and John C. Gerlach *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 279-291 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Some of the instrumentation system used in support of NASA'S Storm Hazards Program are described. These systems include the Radar Atmospheric Research Facility (RARF) with its Space Range Radar and a near real time display from the National Weather Service WSR-57 radar, a lightning detection and ranging system (LDAR), and a Ryan Stormscope. The RARF system can detect, track, and quantify the properties of severe storms. Simultaneous measurements in the UHF (70 cm), S (10 cm), and C (5 cm) bands can be made of clouds and precipitation to deduce particle size and characteristics, including quantitive cross sections of individual hailstones and raindrops. Relative attenuation at these wavelenghts can be used to calculate path integrated rainfall and water content. The track of an instrument aircraft can be displayed on S-band reflectivity map of the individual storm cells. The LDAR system can determine the location of lightning discharges in real time and measure and record the electric field waveform for further study. The Ryan Stormscope can detect and range lightning out to 320 kilometers. M.G.

N81-19050*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE 1979 CLEAR AIR TURBULENCE FLIGHT TEST PROGRAM
E. A. Weaver, L. J. Ehernberger, B. L. Gary, R. L. Kurkowski, P. M. Kuhn (NOAA), and L. P. Stearns (NOAA) *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 293-311 refs Prepared in cooperation with JPL, California Inst. of Tech., Pasadena and Ames Research Center (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The flight experiments for clear air turbulence (CAT) detection and measurement concepts are described. The test were conducted over the western part of the United States during the winter season of 1979 aboard NASA's Galileo 2 flying laboratory. A carbon dioxide pulsed Doppler lidar and an infrared radiometer were tested for the remote detection and measurement of CAT. Two microwave radiometers were evaluated for their ability to provide encounter warning and altitude avoidance information. M.G.

N81-19051*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PULSED DOPPLER LIDAR FOR THE DETECTION OF TURBULENCE IN CLEAR AIR
E. A. Weaver, J. W. Bilbro, J. A. Dunkin, S. C. Johnson, W. D. Jones, C. E. Harris (Raytheon Co.), and C. A. Dimarzio (Raytheon Co.) *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 313-327 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

A pulsed C02 Doppler lidar system is described and demonstration tests in ground-based and airborne flight operations are discussed. As a ground-based system, it can detect wind shears in thunderstorm gust fronts to a range of 6 km. When in the airborne configuration, the lidar can detect clear air turbulence in advance of the aircraft encountering clear air turbulence. The data provided by the lidar included turbulence location and intensity with intensity being indicated by the measured spectral width which is proportional to the wind gust velocity. M.G.

N81-19052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TESTS OF A CLEAR-AIR TURBULENCE ALERTING SYSTEM
Richard L. Kurkowski, Peter M. Kuhn (Raven Systems and Research, Inc.), and Lois P. Stearns (NOAA) *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 329-349 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The detection of clear-air turbulence (CAT) ahead of an aircraft in real-time by an infrared (IR) radiometer is discussed. It is noted that the alter time and reliability depend on the band-pass of the IR filter used and on the altitude of the aircraft. Results of flights tests indicate that a bandpass of 20 to 40 microns appears optimal for altering the aircraft crew to CAT at times before encounter of 2 to 9 min. Alert time increases with altitude, as the atmospheric absorption determining the horizontal weighting is reduced. M.G.

N81-19053*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CLEAR AIR TURBULENCE STUDIES WITH MICROWAVE RADIOMETERS
Bruce L. Gary *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 351-359 refs (For primary document see N81-19035 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The flight testing of two passive microwave radiometers for the detection of clear air turbulence (CAT) is discussed. A 55.3 GHz radiometer was used to measure altitude temperature profiles, and a 180 GHz radiometer was used for monitoring line-of-sight integrated water vapor content. The sequence of altitude temperature profiles, spaced 17 seconds apart (3.5 km), enable inversion layer and tropopause properties to be studied. On some occasions, the altitude distribution of CAT severity correlated well with inversion layer location. On other occasions, turbulence was not located within 55.3 GHz measured layers, possibly indicating cases of topography-generated CAT, where

inversion layer would not necessarily be expected. Evidence was obtained supporting the hypothesis that CAT is generated within layers containing levels of wind shear that cannot be supported by the layer's lapse rate; i.e., that Kelvin-Helmholtz wave breakdown can generate CAT. The 180 GHz radiometer failed to warn of CAT events. It is suggested that the radiometer's sensitivity (1 K) was inadequate for detecting the small variations in line-of-sight water vapor content. M.G.

N81-19054*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

IN-FLIGHT DIRECT-STRIKE LIGHTNING RESEARCH

Felix L. Pitts and Mitchel E. Thomas *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 359-372 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Tests designed to investigate the lightning-generated electromagnetic environment affecting aircraft are discussed. An F-106B aircraft specially instrumented for lightning electromagnetic measurements was used. The instrumentation system is reviewed and typical results recorded by the instrumentation during simulated-lightning ground tests performed for a safety survey are presented. Several examples of data obtained during summer flight testing are presented and future plans are discussed. M.G.

N81-19055*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MAGNITUDE AND FREQUENCY OF WIND SPEED SHEARS AND ASSOCIATED DOWNDRAFTS

Margaret B. Alexander and C. Warren Campbell *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 Mar. 1981 p 373-383 refs (For primary document see N81-19035 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Data are presented indicating the frequency of occurrence of wind shear and downdrafts together with information on the simultaneous occurrence of these two phenomena. High resolution wind profile measurements recorded at a 150 meter ground winds tower facility were used for the analysis. From instantaneous measurements during horizontal wind speeds of gale-force and below intensity, vertical motion at the 10, 60, and 150 m levels was approximately 60 percent downward and 40 percent upward. At the 18 level the percentages were reversed. Updraft maxima were an order of magnitude or two greater than downdrafts at all levels. Frequency of vertical motion > or = 9.7 kts for a year at four levels was 338 occurrences upward and 274 downward. Approximately 90 percent of these upwards occurred at the 18 m level almost equally during summer and winter, and 65 percent of the downdrafts were at the 150 m level during summer. M.G.

N81-19056*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE 1980 AIRCRAFT SAFETY AND OPERATING PROBLEMS, PART 2

Joseph W. Stickle, comp. Mar. 1981 390 p refs Conf. held at Hampton, Va., 5-7 Nov. 1980 2 Vol.

(NASA-CP-2170-Pt-2; L-14254) Avail: NTIS HC A17/MF A01 CSCL 01C

Terminal area operations, avionics and human factors, atmospheric environment, and operating problems and potential solutions are discussed. Other topics include flight experiences, ground operations, and acoustics and noise reduction. For individual titles, see N81-19057 through N81-19075.

N81-19057*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

WADE VORTEX ATTENUATION FLIGHT TESTS: A STATUS REPORT

Marvin R. Barber and Joseph J. Tymczyszyn *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 387-408 refs Prepared in cooperation with FAA, Western Region, Los Angeles (For primary document see N81-19056 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Flight tests were conducted to evaluate the magnitude of aerodynamic attenuation of the wake vortices of large transport aircraft that can be achieved through the use of static spoiler deflection and lateral control oscillation. These methods of attenuation were tested on Boeing B-747 and Lockheed L-1011 commercial transport aircraft. Evaluations were made using probe aircraft, photographic and visual observations, and ground based measurements of the vortex velocity profiles. The magnitude of attenuation resulting from static spoiler deflection was evaluated both in and out of ground effect. A remotely piloted QF-86 drone aircraft was used to probe the attenuated vortices in flight in and out of ground effect, and to make landings behind an attenuated B-747 airplane at reduced separation distances. E.D.K.

N81-19058*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

BASIC RESEARCH IN WAKE VORTEX ALLEVIATION USING A VARIABLE TWIST WING

Dana J. Morris and G. Thomas Holbrook *In its* the 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 409-423 refs (For primary document see N81-19056 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

The variable twist wing concept was used to investigate the relative effects of lift and turbulence distribution on the rolled up vortex wake. Several methods of reducing the vortex strength behind an aircraft were identified. These involve the redistribution of lift spanwise on the wing and drag distribution along the wing. Initial attempts to use the variable twist wing velocity data to validate the WAKE computer code have shown a strong correlation, although the vorticity levels were not exactly matched. E.D.K.

N81-19059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PNEUMATIC BOOT FOR HELICOPTER ROTOR DEICING

Bernard J. Blaha and Peggy L. Evanich *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 425-443 refs (For primary document see N81-19056 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

Pneumatic deicer boots for helicopter rotor blades were tested. The tests were conducted in the 6 by 9 ft icing research tunnel on a stationary section of a UH-1H helicopter main rotor blade. The boots were effective in removing ice and in reducing aerodynamic drag due to ice. E.D.K.

N81-19060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AIRCRAFT OPERATING EFFICIENCY ON THE NORTH ATLANTIC, A CHALLENGE FOR THE 1980'S

Robert Steinberg *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 445-451 (For primary document see N81-19056 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

A number of changes are expected to occur in the near future which could have important consequences for Atlantic flight operations for the next decade. These changes are identified and their impact on aircraft operating efficiency is discussed. Possible alternatives for North Atlantic air carriers are reviewed and strategies and actions are suggested which may give a considerable impact on fuel savings for years to come. E.D.K.

N81-19061*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FIREWORTHINESS OF TRANSPORT AIRCRAFT INTERIOR SYSTEMS

John A. Parker and D. A. Kourtides *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 453-479 refs (For primary document see N81-19056 10-03)

Avail: NTIS HC A17/MF A01 CSCL 01C

The key materials question is addressed concerning the effect of interior systems on the survival of passengers and crew in the case of an uncontrolled transport aircraft fire. Technical opportunities are examined which are available through the modification of aircraft interior subsystem components, modifications that may reasonably be expected to provide improvements in aircraft fire safety. Subsystem components discussed are interior panels, seats, and windows. By virtue of their role in real fire situations and as indicated by the results of large scale simula-

tion tests, these components appear to offer the most immediate and highest payoff possible by modifying interior materials of existing aircraft. These modifications have the potential of reducing the rate of fire growth, with a consequent reduction of heat, toxic gas, and smoke emission throughout the habitable interior of an aircraft, whatever the initial source of the fire. E.D.K.

N81-19062*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COMBUSTION TOXICOLOGY OF EPOXY/CARBON FIBER COMPOSITES

D. E. Cagliostro *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 481-497 (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

A combustion toxicology test was developed to screen materials for aerospace applications. The system is called the radiant panel test facility. A description of the facility and some preliminary results from tests on a Navy 3501-6AS composite, a typical composite for fighter aircraft, are presented. E.D.K.

N81-19063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE USE OF ANTIMISTING KEROSENE (AMK) IN TURBOJET ENGINES

Harold W. Schmidt *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 499-510 (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The effect of antimisting kerosene (AMK) flow characteristics on fan jet engines and the impact of degradation requirements on the fuel system was evaluated. It was determined from the present program that AMK fuel cannot be used without predegradation, although some degradation occurs throughout the fuel feed system, expecially in the fuel pumps. There is a tendency toward FM-9 AMK additive agglomeration and gel formation when the liquid flows at a critical velocity through very small passages. The data indicate this phenomenon to be a function of the degree of degradation, the passage size, the differential pressure, the fluid temperature, and the accumulated flow time. Additionally, test results indicate that the long term cumulative effects of this phenomenon may require more degradation than the theoretical requirement determined from short term tests. E.D.K.

N81-19064*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NASA/FAA GENERAL AVIATION CRASH DYNAMICS PROGRAM

Robert G. Thomson, Robert J. Hayduk, and Huey D. Carden *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 511-540 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The program involves controlled full scale crash testing, nonlinear structural analyses to predict large deflection elastoplastic response, and load attenuating concepts for use in improved seat and subfloor structure. Both analytical and experimental methods are used to develop expertise in these areas. Analyses include simplified procedures for estimating energy dissipating capabilities and comprehensive computerized procedures for predicting airframe response. These analyses are developed to provide designers with methods for predicting accelerations, loads, and displacements on collapsing structure. Tests on typical full scale aircraft and on full and subscale structural components are performed to verify the analyses and to demonstrate load attenuating concepts. A speciel apparatus was built to test emergency locator transmitters when attached to representative aircraft structure. The apparatus is shown to provide a good simulation of the longitudinal crash pulse observed in full scale aircraft crash tests. E.D.K.

N81-19065*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CURRENT RESEARCH IN AIRCRAFT TIRE DESIGN AND PERFORMANCE

John A. Tanner, John L. McCarthy (Michigan Univ., Ann Arbor), and S. K. Clark *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 543-553 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

A review of the tire research programs which address the various needs identified by landing gear designers and airplane users is presented. The experimental programs are designed to increase tire tread lifetimes, relate static and dynamic tire properties, establish the tire hydroplaning spin up speed, study gear response to tire failures, and define tire temperature profiles during taxi, braking, and cornering operations. The analytical programs are aimed at providing insights into the mechanisms of heat generation in rolling tires and developing the tools necessary to streamline the tire design process and to aid in the analysis of landing gear problems. E.D.K.

N81-19066*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

REVIEW OF ANTISKID AND BRAKE DYNAMICS RESEARCH

Sandy M. Stubbs and John A. Tanner *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 555-568 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The behavior of various antiskid systems was investigated under controlled conditions. Results from utilizing a single main wheel of a DC-9 aircraft suggest that the systems investigated perform well under most circumstances but there may be room for improvement. For example, it was demonstrated that pressure bias modulation can adversely affect the response of antiskid systems to rapid changes in the runway friction level. Results also indicate that antiskid systems designed to operate at a slip ratio of approximately 0.1 can provide a maximum braking effort without undue loss in the cornering capability of the tire. Time histories of braking friction coefficient were shown to provide a means of determining antiskid system performance and for systems that employed pressure bias modulation it was shown that performance could also be estimated from time histories of brake pressure and torque. R.C.T.

N81-19067*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STUDIES OF SOME UNCONVENTIONAL SYSTEMS FOR SOLVING VARIOUS LANDING PROBLEMS

T. J. Leland, J. R. McGehee, and R. C Dreher *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 569-582 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Solutions to various landing problems were obtained through unconventional systems. The first, of these is the air cushion landing system, where efforts were concentrated on development of adequate braking and steering systems and an improved understanding of scaling laws and behavior. The second was concentrated on use of a wire brush skid as a drag producing device, which was shown to have good friction coefficients and reasonable wear rates at ground bearing pressures up to 689 kPa and forward speeds up to 80 km/hr. The third showed great promise in an active control landing gear where significant load reductions were possible during landing impact and subsequent rollout. R.C.T.

N81-19068*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RECENT PROGRESS TOWARD PREDICTING AIRCRAFT GROUND HANDLING PERFORMANCE

Thomas J. Yager and Ellis J. White *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 583-611 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The significant progress which has been achieved in development of aircraft ground handling simulation capability is reviewed and additional improvements in software modeling identified. The problem associated with providing necessary simulator input data for adequate modeling of aircraft tire/runway friction behavior is discussed and efforts to improve this complex model, and hence simulator fidelity, are described. Aircraft braking performance data obtained on several wet runway surfaces is compared to ground vehicle friction measurements and, by use of empirically derived methods, good agreement between actual and estimated aircraft braking friction from ground vehilce data is

shown. The performance of a relatively new friction measuring device, the friction tester, showed great promise in providing data applicable to aircraft friction performance. Additional research efforts to improve methods of predicting tire friction performance are discussed including use of an instrumented tire test vehicle to expand the tire friction data bank and a study of surface texture measurement techniques. R.C.T.

N81-19069*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE NASA DIGITAL VGH PROGRAM, EARLY RESULTS
Norman L. Crabill and Garland J. Morris *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 613-624 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Data from airline digital flight data recorders provides relevant statistical data for estimating fatigue life consumption of the current airliner fleet and for design criteria updating for future designs. The data indicates real operating effects due to the autopilot, i.e., gust response frequency peak increase by 2 or 3 times, and the existence of the low frequency low amplitude limit cycle motion in altitude hold. The extension of more data types for ground operations is considered. Onboard processing of simple data types is also considered. R.C.T.

N81-19070*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF EMERGENCY-LOCATOR-TRANSMITTER PERFORMANCE IN REAL AND SIMULATED CRASH TESTS
Huey D. Carden *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 625-653 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Emergency locator transmitter (ELT) activation problems were investigated by testing a sampling of ELT units in actual airplane crashes and in a special test apparatus which simulated longitudinal crash pulses with superimposed local structural resonances. Probable causes of excessive false alarms and nonactivations of ELT's during crash situations were determined and solutions to the current operational and technical problems were obtained. The results, which considered placement, mounting, and activation of ELT's under simulated crash impacts, and an evaluation of the sensitivity of ELT impact switches to orientation and to local structural vibrations are discussed. R.C.T.

N81-19071*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXTINGUISHING IN-FLIGHT ENGINE FUEL-LEAK FIRES WITH DRY CHEMICALS
Robert L. Altman *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 655-668 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The fire extinguishant storage temperature requirements were examined for several commercially available dry chemicals. Particular emphasis was placed on the development of dry powder extinguishant that, when discharged into a jet engine fuel leak fire, would stick to the hot surfaces. Moreover, after putting out the initial fire, these extinguishants would act as antireignition catalysts, even when the fuel continued to leak onto the heated surface. R.C.T.

N81-19072*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECENT DEVELOPMENTS IN AIRCRAFT ENGINE NOISE REDUCTION TECHNOLOGY
James R. Stone and Charles E. Feiler *In* NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 671-698 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Some of the more important developments and progress in jet and fan noise reduction and flight effects are reviewed. Experiments are reported which show that nonaxisymmetric coannular nozzles have the potential to reduce jet noise for conventional and inverted velocity profiles. It is shown that an improved understanding of suppressive linear behavior, coupled with the new understanding of fan source noise, will soon allow the joint optimization of acoustic liner and fan design for low noise. It is also shown that fan noise source reduction concepts are applicable to advanced turboprops. Advances in inflow control device design are reviewed that appear to offer an adequate approach to the ground simulation of inflight fan noise. R.C.T.

N81-19073*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOURCES, CONTROL, AND EFFECTS OF NOISE FROM AIRCRAFT PROPELLERS AND ROTORS
John S. Mixson, George C. Greene, and Thomas K. Dempsey *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 699-720 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Source noise predictions are compared with measurements for conventional low-speed propellers, for new high speed propellers (propfans), and for a helicopter. Results from a light aircraft demonstration program are described, indicating that about 5-dB reduction of flyover noise can be obtained without significant performance penalty. Sidewall design studies are described for interior noise control in light general aviation aircraft and in large transports using propfan propulsion. The weight of the added acoustic treatment is estimated and tradeoffs between weight and noise reduction are discussed. A laboratory study of passenger response to combined broadband and tonal propeller like noise is described. Subject discomfort ratings of combined tone broadband noises are compared with ratings of broadband (boundary layer) noise alone, and the relative importance of the propeller tones is examined. R.C.T.

N81-19074*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NASA PROGRESS IN AIRCRAFT NOISE PREDICTION
J. P. Raney, S. L. Padula, and W. E. Zorumski *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 721-757 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

Some of the essential features of aircraft noise prediction are described and the basis for evaluating its capability and future potential is discussed. A takeoff noise optimizing procedure is described which calculates a minimum noise takeoff procedure subject to multiple site noise constraints. R.C.T.

N81-19075*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRPORT NOISE IMPACT REDUCTION THROUGH OPERATIONS
Richard Deloach *In its* The 1980 Aircraft Safety and Operating Probl., Pt. 2 Mar. 1981 p 759-778 refs (For primary document see N81-19056 10-03)
Avail: NTIS HC A17/MF A01 CSCL 01C

The effects of various aeronautical, operational, and land-use noise impact reduction alternatives are assessed for a major midwestern airport. Specifically, the relative effectiveness of adding sound absorbing material to aircraft engines, imposing curfews, and treating houses with acoustic insulation are examined.R.C.T.

N81-19076# Finnish Meteorological Inst., Helsinki.
AN OPERATIVE WIND SHEAR AND INVERSION WARNING SYSTEM FOR HELSINKI-VANTAA AIRPORT
Ossi Korhonen Aug. 1980 25 p refs
(ISBN-951-697-139-3; ISSN-0355-1733; TR-24) Avail: NTIS HC A02/MF A01

The system has some data banking capabilities. Real time cross-sections are available in graphical or numerical form at any moment. The station is able to observe low-level wind, temperature, and humidity profiles continuously. Most data are used by the meterologist in the preparation of low-level wind shear and inversion warnings for the airport but the system is also a useful tool for weather observation, especially when where is an advection of coastal fog or low clouds. T.M.

N81-19077# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: AIR PENNSYLVANIA 501, PIPER PA-31-350, N5MS PHILADELPHIA, PENNSYLVANIA,

JULY 25, 1980
21 Jan. 1981 27 p
(PB81-910401; NTSB-AAR-81-1) Avail: NTIS HC A03/MF A01 CSCL 01C

The crash of the Air Pennsylvania 50 1, a Piper PA-31-350 Navajo aircraft, while making a visual approach at Philadelphia International Airport is examined. The aircraft, a scheduled commuter flight from Reading, Pennsylvania, arrived in the Philadelphia approach control area as a VFR pop-up flight and was sequenced to land behind United Flight 555, a Boeing 727 IFR arrival. Witnesses stated that, when Flight 501 was about 1/2 mile on final approach, it rolled from side to side, pitched up, rolled inverted to the left, and flew into the ground nose first. All three persons aboard the aircraft was killed and the aircraft was destroyed. It was determined that the probable cause of the accident was the loss of aircraft control due to an encounter with wake turbulence from the preceding aircraft at an altitude too low for recovery and the pilot's failure to follow established separation and flightpath selection procedures for wake turbulence avoidance. M.G.

N81-19078*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURVEY OF AIRCRAFT ICING SIMULATION TEST FACILITIES IN NORTH AMERICA
William Olsen Feb. 1981 26 p refs
(NASA-TM-81707; E-736) Avail: NTIS HC A03/MF A01 CSCL 01C

A survey was made of the aircraft icing simulation facilities in North America: there are 12 wind tunnels, 28 engine test facilities, 6 aircraft tankers and 14 low velocity facilities, that perform aircraft icing tests full or part time. The location and size of the facility, its speed and temperature range, icing cloud parameters, and the technical person to contact are surveyed. Results are presented in tabular form. The capabilities of each facility were estimated by its technical contact person. The adequacy of these facilities for various types of icing tests is discussed. S.F.

N81-19079*# Rockwell International Corp., Los Angeles, Calif. Thermodynamics Group.
LIGHT TRANSPORT AND GENERAL AVIATION AIRCRAFT ICING RESEARCH REQUIREMENTS Final Report
R. K. Breeze and G. M. Clark 20 Mar. 1981 348 p refs
(Contract NAS3-22186)
(NASA-CR-165290; NA-81-110) Avail: NTIS HC A15/MF A01 CSCL 01C

A short term and a long term icing research and technology program plan was drafted for NASA LeRC based on 33 separate research items. The specific items listed resulted from a comprehensive literature search, organized and assisted by a computer management file and an industry/Government agency survey. Assessment of the current facilities and icing technology was accomplished by presenting summaries of ice sensitive components and protection methods; and assessments of penalty evaluation, the experimental data base, ice accretion prediction methods, research facilities, new protection methods, ice protection requirements, and icing instrumentation. The intent of the research plan was to determine what icing research NASA LeRC must do or sponsor to ultimately provide for increased utilization and safety of light transport and general aviation aircraft. Author

N81-19080# Naval Air Engineering Center, Lakehurst, N.J. Ship and Shore Installations Engineering Dept.
SYSTEM SAFETY PROGRAM REPORT MK 1 MOD 0 LSO HUD CONSOLE SYSTEM Final Report
John Glenn 30 Jan. 1981 26 p
(AD-A095009; NAEC-91-7983) Avail: NTIS HC A03/MF A01 CSCL 01/2

The MK 1 MOD 0 LSO HUD Console System provides aircraft recovery information to the Landing Signal Officer aboard aircraft carriers. This report documents the System Safety Program accomplishments (safety analysis, verification, and test) and assesses system safety. GRA

N81-19081# RANN, Inc., Palo Alto, Calif.
EXPLORATORY STUDY OF THE ORGANIZATION AND MANAGEMENT OF HAZARD MITIGATION IN THE CIVIL AIR TRANSPORT SYSTEM
C. W. Harper, B. A. Smith, J. D. Young, R. L. Bisplinghoff, P. G. Dembling, and A. J. Eggers, Jr. 26 Jan. 1981 71 p refs Sponsored by Federal Emergency Management Agency
(AD-A095081) Avail: NTIS HC A04/MF A01 CSCL 05/1

This exploratory study suggests that organization and management principles and procedures for hazard mitigation derived from the long experience with this objective in the air civil transport system may prove of great value in the development of hazard mitigation activities associated with other major technological systems of national concern. Cited in the report are examples where difficulties may have already arisen from non-observance of some of these principles and where difficulties may arise in future endeavors if these principles are not observed. GRA

N81-19082# Rolls-Royce Ltd., Derby (England).
AMERICAN AIRSHIP PROJECT FOR CITY-AIRPORT CONNECTION GOODYEAR AEROSPACE CORPORATION
Jacques Plaignaud 1980 16 p Transl. into ENGLISH from ITA Bull., v. 7, no. 17/5-134/A p 437-441 Partly in ENGLISH and FRENCH
(PNR-90020; Trans-15254) Avail: NTIS HC A02/MF A01

The use of a four engined airship for short haul passenger and freight service is discussed and cost comparisons made with conventional aircraft, using the NASA Cost Estimating Relationship. Direct operating costs per item of expenditure and results of a sensitivity analysis covering direct operating costs are given. Operating cost per seat-mile varies from five cents to seven cents. In terms of operating economy, fuel consumption and noise levels, the airship feeder is found as promising as competitive aircraft. Author (ESA)

N81-19083# National Academy of Sciences - National Research Council, Washington, D. C.
IMPROVING AIRCRAFT SAFETY
Jun. 1980 131 p refs
(Contract DTOS59-80-C-00028)
(PB81-114886; ISBN-0-309-03091-9; LC-80-82605) Avail: NTIS HC A07/MF A01 CSCL 01C

A six month assessment of the adequacy of the Federal Aviation Administration's policies and procedures for certifying the airworthiness of commercial transport aircraft was undertaken. Airworthiness is the aspect of air safety related to the design, manufacture, and maintenance of airplanes and does not embrace such other key safety matters as airlines and flight crew operations or air traffic control. The ways in which the FAA approves the design, fabrication, and production of each new aircraft, as well as the maintenance and continuing airworthiness of each airplane were considered. Concentrating on the large passenger aircraft used by the major commercial airlines, the committee's charter excluded from its study the certification of engines, airplanes operated by commuter airlines, businesses, and individuals, as well as aircraft under 12,500 pounds. GRA

N81-19005*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IN FLIGHT DIRECT STRIKE LIGHTNING RESEARCH
Felix L. Pitts *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 43-65 refs (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N81-19084# Massachusetts Inst. of Tech., Cambridge.
ACTIVE BCAS: DESIGN AND VALIDATION OF THE

SURVEILLANCE SUBSYSTEM

William H. Harman, Jerry D. Welch, Raymond R. LaFrey, and M. Loren Wood 17 Dec. 1980 118 p refs
(Contracts F19628-80-C-0002; DOT-FA72WAI-817; FAA Proj. 054-241-04)
(AD-A095049; ATC-103; FAA-RD-80-134) Avail: NTIS HC A06/MF A01 CSCL 17/7

Lincoln Laboratory, under FAA sponsorship, is developing an Active Beacon Collision Avoidance System (BCAS), concentrating primarily on the air-to-air surveillance subsystem. The surveillance functions required are to detect the presence of nearby aircraft (whether they are equipped with ATCRBS transponders or DABS transponders), and then generate a surveillance track on each aircraft, issuing range and altitude reports once per second. The development effort consisted of airborne measurements complemented by simulation studies and analyses. The basic effects of ground-bounce multipath, interference, and power fading were assessed by air-to-air measurements. In other measurements, the BCAS interrogation and reply signal formats were transmitted between aircraft, and the results recorded for later playback and computer processing using the BCAS surveillance algorithms. This is a flexible means of experimentation which allows many of the design parameters to be changed as the effects are noted. In the most recent phase of the program, Lincoln designed and built realtime BCAS Experimental Units (BEUs), flight tested them, and then delivered them to the FAA for more extensive flight testing. In one of these flight tests, a BEU-equipped Boeing 727 flew to New York, Atlanta, and other major terminal areas in the eastern U.S. An analysis of BEU performance during this 'Eastern Tour' is given in this report. GRA

N81-19085# Federal Aviation Administration, Atlantic City, N.J.
MATH MODEL STUDY, RUNWAY 16R INSTRUMENT LANDING SYSTEM LOCALIZER AT SEATTLE-TACOMA AIRPORT, WASHINGTON Data Report, period ending Aug. 1980

Jesse D. Jones Jan. 1981 25 p refs
(AD-A095076; FAA-CT-80-61) Avail: NTIS HC A02/MF A01 CSCL 17/7

Results of a math model study for the runway 16R instrument landing system (ILS) localizer at the Seattle-Tacoma Airport, Washington, are presented. This study was performed at the request of the Northwest Region of the Federal Aviation Administration (FAA) to determine the effects to the course structure of a proposed building and the replacement of the existing ILS localizer system. Resultant course structure plots are presented for both the existing Texas Instruments Basic Parabolic Category II Localizer and the proposed Wilcox 14/6 Category III Localizer, with and without the effects of the proposed Boeing building. The course structure plots are the output from the ILSLOC mathematical model computer program developed by the Transportation Systems Center and run on the Honeywell 66/60 computer at the FAA Technical Center. GRA

N81-19086# Systems Control, Inc., Palo Alto, Calif.
MULTITARGET TRACKING STUDIES Final Report, 5 Oct. 1979 - 3 Jun. 1980

Ben Friedlander Jul. 1980 84 p refs
(Contract N00014-79-C-0743; NR Proj. 277-287; RR0141101)
(AD-A094581; SCI-5334-01) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report presents the results of phase 1 of an investigation of a new concept for tracking multiple targets. This concept is based on modeling the observed data as a multichannel ARMA process. The parameters of the model provide a compact representation of target parameters such as spectrum and TDOA/bearing. These parameters can, therefore, be used as inputs to a tracking algorithm. In phase 1 the basic algorithm for single target tracking was developed and tested. Results based on simulations of synthetic data are very promising. Preliminary theoretical analysis of the multichannel case has also been performed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N81-19087* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPENSATING LINKAGE FOR MAIN ROTOR CONTROL Patent

Philip A. E. Jeffery (United Aircraft Corp., Stratford, Conn.) and Rudolf F. Huber, inventors (to NASA) (United Aircraft Corp., Stratford, Conn.) Issued 20 Jan. 1981 6 p Filed 25 Dec. 1978 Supersedes N79-15057 (17 - 06, p 0694) Sponsored by NASA
(NASA-Case-LAR-11797-1; US-Patent-4,245,956; US-Patent-Appl-SN-969755; US-Patent-Class-416-114; US-Patent-Class-244-17.25; US-Patent-Class-416-500; US-Patent-Class-74-519) Avail: US Patent and Trademark Office CSCL 01C

A compensating linkage for the rotor control system on rotary wing aircraft is described. The main rotor and transmission are isolated from the airframe structure by elastic suspension. The compensating linkage prevents unwanted signal inputs to the rotor control system caused by relative motion of the airframe structure and the main rotor and transmission.

Official Gazette of the U.S. Patent and Trademark Office

N81-19088*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 1: MAIN PROGRAM. PART 1: THEORETICAL DEVELOPMENT

D. Hague Jan. 1978 197 p refs 6 Vol.
(Contract NAS2-9352)
(NASA-CR-152303-Vol-1-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 01C

The General Aviation synthesis program performs tasks generally associated with aircraft preliminary design and allows an analyst the capability of performing parametric studies in a rapid manner. GASP emphasizes small fixed-wing aircraft employing propulsion systems varying from a single piston engine with fixed pitch propeller through twin turboprop/ turbofan powered business or transport type aircraft. The program, which may be operated from a computer terminal in either the batch or interactive graphic mode, is comprised of modules representing the various technical disciplines integrated into a computational flow which ensures that the interacting effects of design variables are continuously accounted for in the aircraft sizing procedure. The model is a useful tool for comparing configurations, assessing aircraft performance and economics, performing tradeoff and sensitivity studies, and assessing the impact of advanced technologies on aircraft performance and economics. A.R.H.

N81-19089*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 2: GEOMETRY. PART 1: THEORETICAL DEVELOPMENT

D. Hague Jan. 1978 26 p refs 6 Vol.
(Contract NAS2-9352)
(NASA-CR-152303-Vol-2-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 01C

The gross characteristics of an aircraft under study are specified to the subroutines SIZE. The principal quantities specified are both geometric (lengths and areas) and operational (altitude and Mach number). The sequence of computations carried out by SIZE is controlled by the parameter NPC which is passed into SIZE by COMMON. When NPC-0, the computation is initialized. Subsequently, NPC is set to 2 and the program advances through the geometric computations. Geometry models for the fuselage, wing, empennage, cabin pressurization, and nacelle area are examined. A.R.H.

N81-19090*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 3: AERODYNAMICS. PART 1: THEORETICAL DEVELOPMENT

D. Hague Jan. 1978 103 p refs 6 Vol.
(Contract NAS2-9352)
(NASA-CR-152303-Vol-3-Pt-1) Avail: NTIS
HC A06/MF A01 CSCL 01C

Aerodynamics calculations are treated in routines which concern moments as they vary with flight conditions and attitude. The subroutines discussed: (1) compute component equivalent flat plate and wetted areas and profile drag; (2) print and plot low and high speed drag polars; (3) determine life coefficient or angle of attack; (4) determine drag coefficient; (5) determine maximum lift coefficient and drag increment for various flap types and flap settings; and (6) determine required lift coefficient and drag coefficient in cruise flight. A.R.H.

N81-19091*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 4: PROPULSION. PART 1: THEORETICAL DEVELOPMENT
D. Hague Jan. 1978 191 p refs 6 Vol.
(Contract NAS2-9352)
(NASA-CR-152303-Vol-4-Pt-1) Avail: NTIS
HC A09/MF A01 CSCL 01C

Propulsion system performance is computed during engine sizing and whenever aircraft performance is computed. The propulsion model user's and programmer's manual is presented. Routines are provided for jet and propeller driven aircraft. A.R.H.

N81-19092*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 5: WEIGHTS. PART 1: THEORETICAL DEVELOPMENT
D. Hague Jan. 1978 151 p refs 6 Vol.
(Contract NAS2-9352)
(NASA-CR-152303-Vol-5-Pt-1) Avail: NTIS
HC A08/MF A01 CSCL 01C

Subroutines for determining the weights of propulsion system related components and the airframe components of an aircraft configuration are presented. Subroutines that deal with design load conditions, aircraft balance, and tail sizing are included. Options for turbine and internal combustion engines are provided. A.R.H.

N81-19093*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 6: PERFORMANCE. PART 1: THEORETICAL DEVELOPMENT
D. Hague Jan. 1978 121 p refs 6 Vol.
(Contract NAS2-9352)
(NASA-CR-152303-Vol-6-Pt-1) Avail: NTIS
HC A06/MF A01 CSCL 01C

Aircraft performance modeling requires consideration of propulsion, aerodynamics, and weight characteristics. Eleven subroutines used in modeling aircraft performance are presented and their interactions considered. Manuals for performance model users and programmers are included. A.R.H.

N81-19094*# Aerophysics Research Corp., Bellevue, Wash.
GASP- GENERAL AVIATION SYNTHESIS PROGRAM. VOLUME 7: ECONOMICS. PART 1: THEORETICAL DEVELOPMENT
Jan. 1978 39 p refs
(Contract NAS2-9352)
(NASA-CR-152303-Vol-7-Pt-1) Avail: NTIS
HC A03/MF A01 CSCL 01C

The economic analysis includes: manufacturing costs; labor costs; parts costs; operating costs; markups and consumer price. A user's manual for a computer program to calculate the final consumer price is included. S.F.

N81-19095*# Grumman Aerospace Corp., Bethpage, N.Y.
VTOL IN GROUND EFFECT FLOWS FOR CLOSELY SPACED JETS Final Report
David Migdal, William G. Hill, Jr., and Richard C. Jenkins Dec. 1979 195 p refs
(Contract NAS2-10097)
(NASA-CR-152321) Avail: NTIS HC A09/MF A01 CSCL 01C

Results of a series of in ground effect twin jet tests are presented along with flow models for closely spaced jets to help predict pressure and upwash forces on simulated aircraft surfaces. The isolated twin jet tests revealed unstable fountains over a range of spacings and jet heights, regions of below ambient pressure on the ground, and negative pressure differential in the upwash flow field. A separate computer code was developed for vertically oriented, incompressible jets. This model more accurately reflects fountain behavior without fully formed wall jets, and adequately predicts ground isobars, upwash dynamic pressure decay, and fountain lift force variation with height above ground. E.A.K.

N81-19096*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYTICAL STUDY OF STOL AIRCRAFT IN GROUND EFFECT. PART 1: NONPLANAR, NONLINEAR WING/JET LIFTING SURFACE METHOD
C. A. Shollenberger and D. N. Smyth Mar. 1978 91 p refs
(Contract NAS2-9319)
(NASA-CR-152087-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 01C

A nonlinear, nonplanar three dimensional jet flap analysis, applicable to the ground effect problem, is presented. Lifting surface methodology is developed for a wing with arbitrary planform operating in an inviscid and incompressible fluid. The classical, infintely thin jet flap model is employed to simulate power induced effects. An iterative solution procedure is applied within the analysis to successively approximate the jet shape until a converged solution is obtained which closely satisfies jet and wing boundary conditions. Solution characteristics of the method are discussed and example results are presented for unpowered, basic powered and complex powered configurations. Comparisons between predictions of the present method and experimental measurements indicate that the improvement of the jet with the ground plane is important in the analyses of powered lift systems operating in ground proximity. Further development of the method is suggested in the areas of improved solution convergence, more realistic modeling of jet impingement and calculation efficiency enhancements. Author

N81-19097*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYTICAL STUDY OF STOL AIRCRAFT IN GROUND EFFECT. PART 2: NONPLANAR, NONLINEAR METHOD APPLICABLE TO THREE DIMENSIONAL JETS OF FINITE THICKNESS
C. A. Shollenberger Mar. 1978 36 p refs
(Contract NAS2-9319)
(NASA-CR-152088-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 01C

The ability of the potential flow analysis (POTFAN) to predict the influence of ground proximity on lift systems is examined. A two dimensional study employing vortex lattice methodology provides confidence that ground effect phenomenon can be predicted using discrete singularity representation. Two dimensional quasi-steady ascent and descent behavior determined provides guidance in interpreting three dimensional results. Steady and quasi-steady ground effect aerodynamic characteristics predicted by POTFAN are presented for several basic unpowered configurations. POTFAN results are compared with experimental data and results of other analytical methods. Modification of POTFAN to incorporate multienergy flow analysis is discussed. General aspects of thick jet models are examined to provide a basic for extending POTFAN's scope to include analysis of propulsive lift interactions. S.F.

N81-19098*# Systems Control, Inc., Palo Alto, Calif.
DEVELOPMENT OF ADVANCED TECHNIQUES FOR ROTORCRAFT STATE ESTIMATION AND PARAMETER IDENTIFICATION
W. E. Hall, Jr., J. G. Bohn, and J. H. Vincent Nov. 1980 265 p refs
(Contract NAS1-14549)
(NASA-CR-159297) Avail: NTIS HC A12/MF A01 CSCL 01C

An integrated methodology for rotorcraft system identification consists of rotorcraft mathematical modeling, three distinct data processing steps, and a technique for designing inputs to improve the identifiability of the data. These elements are as follows: (1) a Kalman filter smoother algorithm which estimates states

and sensor errors from error corrupted data. Gust time histories and statistics may also be estimated; (2) a model structure estimation algorithm for isolating a model which adequately explains the data; (3) a maximum likelihood algorithm for estimating the parameters and estimates for the variance of these estimates; and (4) an input design algorithm, based on a maximum likelihood approach, which provides inputs to improve the accuracy of parameter estimates. Each step is discussed with examples to both flight and simulated data cases. A.R.H.

N81-19099*# National Aeronautics and Space Administration. *Langley Research Center, Hampton, Va.*

PRELIMINARY WIND-TUNNEL INVESTIGATION OF THE EFFECTS OF ENGINE NACELLES ON A TRANSPORT *CONFIGURATION WITH HIGH LIFT DRAG RATIOS TO A* MACH NUMBER OF 1.00

Stuart G. Flechner 18 Feb. 1971 20 p ref
(NASA-TM-82312; LWP-939) *Avail: NTIS HC A02/MF A01*
CSCL 01C

Wind tunnel tests to determine the effect of engine nacelles *added to a low wing fuselage vertical tail configuration utilizing* the NASA supercritical airfoil and a refined area ruled fuselage are discussed. The engine *arrangement consisted of two aft fuselage, side* mounted flow through nacelles and a solid body of revolution mounted above the fuselage in a manner similar to the Boeing 727. A *preliminary analysis of the wind tunnel* data shows that favorable interference drag can be obtained with the proper longitudinal locations of the nacelles, by canting the nacelle inlets, and by cusping the *rearward region of the* nacelle. M.G.

N81-19100*# *National Aeronautics and Space Administration.* Ames Research Center, Moffett Field, Calif.

HISTORICAL OVERVIEW OF V/STOL AIRCRAFT TECHNOL-*OGY*

Seth B. Anderson Mar. 1981 16 p
(NASA-TM-81280; A-8511) Avail: NTIS HC A02/MF A01
CSCL 01C

The requirements for satisfactory characteristics in several key technology areas are discussed and a review is made of various V/STOL aircraft for the purpose of assessing the success or failure of each design in meeting design requirements. Special operating techniques were developed to help circumvent deficiencies. For the most part performance and handling qualities limitations restricted operational evaluations. Flight operations emphasized the need for good STOL performance, good handling qualities, and stability and control augmentation. The majority of aircraft suffered adverse ground effects. T.M.

N81-19101*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE ROLE OF THE RESEARCH SIMULATOR IN THE SYSTEMS DEVELOPMENT OF ROTORCRAFT

Irving C. Statler and Arlin Deel Mar. 1981 25 p refs Prepared in cooperation with Army Aviation and Development Command, Moffet Field, Calif.
(NASA-TM-81276; USAAVRADCOM-TR-81-A-7) Avail: NTIS HC A02/MF A01 CSCL 01C

The potential application of the research simulator to future rotorcraft systems design, development, product improvement evaluations, and safety analysis is examined. Current simulation capabilities for fixed-wing aircraft are reviewed and the requirements of a rotorcraft simulator are defined. The visual system components, vertical motion simulator, cab, and computation system for a research simulator under development are described. M.G.

N81-19102# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

WIND TUNNEL TESTS TO DETERMINE THE BEHAVIOR DURING EJECTION OF EXTERIOR STORES AT HIGH AND LOW SPEEDS [WINDKANALUNTERSUCHUNGEN ZUR ERMITTLUNG DES ABGANGSVERHALTENS VON AUSSENLASTEN IM NIEDER- UND HOCHGESCHWINDIGKEITSBEREICH]

P. Esch and T. Windeck 1979 13 p refs In GERMAN Presented at DGLR Symp. on der Abgang von Lasten und Waffen vom Traeger, Bad Neuenahr, West Germany, 26-27 Nov. 1979 (DLGR-79-096) Avail: NTIS HC A02/MF A01

Wind tunnel simulation of an actual flying test was undertaken *to test the ejection behavior of external loads. Experiments with* these dynamic procedures require examining of questionable conditions which require complicated research methods and *techniques when testing for low speed and high speed ranges.* The wind tunnel technique which uses hypotheses and speed measurements, the Froude number, the heavy model method, *and the light model method, is routinely employed in low and* high speed research. Besides a description of the research methods and techniques, the influences of different parameters are shown *and examples are given of comparisons between the launching* of simulated and actual models. Transl. by E.A.K.

N81-19103# *Naval Research Lab., Washington, D. C.* Information Processing Systems Branch.

EVALUATION OF THE A-7 REQUIREMENTS DOCUMENT BY ANALYSIS OF CHANGE DATA Interim Report

Victor R. Basili (Maryland Univ.) and David M. Weiss 29 Dec. 1980 21 p *refs*
(RR0140941)
(AD-A094888; NRL-8445) Avail: NTIS HC A02/MF A01
CSCL 09/2

We describe in this report an effective data collection method for evaluating software development methodologies, from *definition of the objectives of the data collection to analysis of* the results. We show how the data analysis can answer questions with respect to how successfully the goals of the development *methodology are met. The A-7 requirements document is used* as an example. We provide the results of data analyses conducted partway through the A-7 flight software development cycle, and *we discuss the utility of information obtained by such partial* analyses. Results from the study show that data collection is feasible and useful when performed as part of configuration control, *that data distributions based on partial data provided useful* feedback to the developers, and that the A-7 requirements document is easily maintained and changed. GRA

N81-19104# Hughes Helicopters, Culver City, Calif.

A COMPUTERIZED BALANCING TECHNIQUE FOR SUPERCRITICAL HELICOPTER SHAFTING Final Report, Sep. 1978 - Feb. 1980

G. J. Korkosz St. Louis, Mo. USAVRADCOM Dec. 1980 55 p
(Contract DAAK51-78-C-0021)
(AD-A095143; HH-80-223; USAAVRADCOM-TR-80-F-15)
Avail: NTIS HC A04/MF A01 CSCL 14/2

A full-size supercritical helicopter tail rotor drive shaft has been balanced using a quasi-static data acquisition technique. The method employs ultrasonic gaging equipment and a digital computer to determine the amount and location of the balance correction. In one 15 minute pass, the system has demonstrated the ability to locate the center of gravity (CG) of the shaft within 0.001 inch. The balanced shaft has run at speeds up to 10,500 rpm, including sustained operation at four critical speeds, with acceptable vibration at critical speeds. Operation at the design speed (between 2nd and 3rd critical speed) was well within standard high quality balance values. GRA

N81-19105# Lockheed-Georgia Co., Marietta.

FEASIBILITY STUDY FOR C-141B REDUCTION OF WING LOADS BY UPRIGGING THE AILERONS

Gene S. Jamison 10 Sep. 1980 35 p refs
(Grant F09603-80-G-0417)
(AD-A094634; LG80ER0144) Avail: NTIS HC A03/MF A01
CSCL 01/3

This report summarizes an investigation into the feasibility of uprigging the ailerons on the C-141B to reduce wing loads. The potential wing loads reductions were based on early wind tunnel data and were corroborated by recent flight test data at a mid-span location. Crack growth computations were made for four wing locations. Significant increases in structural safety limits for the two lower surface locations ranged from an improvement factor of 1.18 (3 deg uprig) to 2.731 (6 deg uprig) depending on location. Similar percentage increases could be expected in inspection intervals and structural durability. Two wing upper surface locations showed no significant change from aileron uprigging. An examination of the potential impact on pitch trim

requirements, roll response and dutch roll characteristics indicated only negligible effects from moderate aileron uprigging. GRA

N81-19106# Bell Helicopter Co., Fort Worth, Tex.
HELICOPTER EXTERNAL LOAD ACQUISITION TECHNOLOGY INVESTIGATION Final Report
Herman Franks and B. C. Bowen Dec. 1980 94 p refs
(Contract DAAK51-79-C-0058; DA Proj. 1L1-62209-AH-76)
(AD-A094672; USAAVRADCOM-TR-80-D-28) Avail: NTIS HC A05/MF A01 CSCL 01/2

The purpose of this study was to identify, analyze, and evaluate methods of improving the acquisition of sling and/or netted loads by a hovering helicopter under poor visibility and other hazardous conditions. Flight and ground crew tasks required to support the external cargo operations were analyzed and resulting baseline crew workloads defined. Hazard analyses of the mission phases were accomplished and hazard categories identified. The results of these analyses were then used as criteria for selecting potential concept candidates for improvement in external load acquisition. Ten candidate concepts were identified. Each was evaluated against established baselines and then ranked in order of improvement over the baseline concept. GRA

N81-19107# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TIME-CONSTRAINED MAXIMUM-ENERGY TURNS M.S. Thesis
Steven Petersen Dec. 1980 73 p refs
(AD-A094733; AFIT/GAE/AA/80D-17) Avail: NTIS HC A04/MF A01 CSCL 01/2

The object of this study is to find the trajectories which a high performance aircraft would employ to maximize the change in specific energy during a prescribed turn. These values of the change in specific energy are compared to the changes in specific energy which result from a minimum time turn. A suboptimal control approach, which uses both gradient and second order techniques, is employed to find the maximum specific energy trajectories. The results of the study show that turning times slightly greater than the minimum turning time allow large increases in aircraft specific energy and that the trajectories can be flown with simple control inputs. GRA

N81-19108# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF THREE EXTENDED KALMAN FILTERS FOR AIR-TO-AIR TRACKING M.S. Thesis
William H. Worsley Dec. 1980 349 p refs
(AD-A094767; AFIT/GAE/AA/80S-2) Avail: NTIS HC A15/MF A01 CSCL 19/5

The performances of the extended Kalman filter implementations for three different target acceleration models that estimate target position, velocity, and acceleration states for air-to-air gunnery were compared. The models included (1) a first order zero-mean Gauss-Markov relative target acceleration model, (2) a first order zero-mean Gauss-Markov total target acceleration, and (3) a constant turn rate target acceleration model. Measurements available to the extended Kalman filter at update were the range, range rate, and the error angles between the true line of sight and the estimated line of sight. Additional evaluations of the effect of variations in the length of the sample period and the effect of variations in the variances of the measurement noises were conducted for the extended Kalman filter using the constant turn rate target acceleration model. All evaluations were accomplished using Monte Carlo simulation techniques. GRA

N81-19109# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF AN IMPROVED FLUTTER SPEED PREDICTION TECHNIQUE FOR DAMAGED T-38 HORIZONTAL STABILATORS USING NASTRAN M.S. Thesis
Roger Kent Thomson Dec. 1980 154 p refs
(AD-A094769; AFIT/GAE/AA/80D-21) Avail: NTIS HC A08/MF A01 CSCL 01/3

This thesis concerns the development of a finite element model of the T-38 horizontal stabilator for use on NASTRAN. The model is to be used to analyse degradations in flutter speed due to repair. Static analysis has shown the model to be lacking in torsional stiffness, the probable cause being the inability of NASTRAN plate bending elements to model torsion cells. An increase of elastic and shear moduli of plate bending elements in the model by 30 percent produced more accurate results but additional investigation is necessary. Modal analysis has pointed to a modeling error in the root, trailing edge area. The affect has caused an additional node to appear on the trailing edge for modes above 100 cps in a free-free condition. Investigation of the steady aerodynamic pressure distribution over the stabilator shows good correlation with experimental results. A flutter analysis procedure was established and the affects of the errors found in the structural model were investigated. With no corrections made to the model, a flutter speed equivalent to that predicted using strip theory was achieved for the sea level condition. GRA

N81-19110*# National Academy of Sciences - National Research Council, Washington, D. C. Ad Hoc Committee on Aircraft Energy.
AN EVALUATION OF NASA'S PROGRAM FOR IMPROVING AIRCRAFT FUEL EFFICIENCY Final Report
1980 25 p refs
(Contract NASw-2342)
(NASA-CR-164015; PB81-116790) Avail: NTIS HC A02/MF A01 CSCL 01C

The report provides commentary and recommendations where appropriate on each of the major elements of the program. Key findings of the committee included a recommendation that closer ties be established between NASA and the FAA to expedite the use and acceptance of the new technology. The committee also cited the potential for fuel savings through an imporved air traffic control system and recommended that the management of NASA and the FAA discuss ways and means to work together to exploit more effectively the capabilities and responsibilities of each to develop air traffic control. GRA

N81-19003*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS AND FUTURE PLANS OF THE DRONES FOR AERODYNAMIC AND STRUCTURAL TESTING (DAST) PROGRAM
Harold N. Murrow *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 21-36 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19004*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSPORT AIRCRAFT FLYING QUALITIES ACTIVITIES
Martin T. Moul *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 37-42 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19007*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SMALL TRANSPORT AIRCRAFT TECHNOLOGY
Thomas L. Galloway *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 85-104 refs (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19008*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVESTIGATION OF POWERED NACELLES ON A HIGH ASPECT RATIO NASA SUPERCRITICAL WING, PHASE 2 Status Report
Stuart G. Flechner, James C. Patterson, Jr., and Paul G. Fournier *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 105-122 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19011*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
KC-135 WINGLET FLIGHT RESULTS
Lawrence C. Montoya *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 145-156 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19012*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OVERVIEW OF ADVANCED WING DESIGN
Raymond M. Hicks *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 157-169 ref (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-19111*# RAND Corp., Santa Monica, Calif.
PREDICTING COST/RELIABILITY/MAINTAINABILITY OF ADVANCED GENERAL AVIATION AVIONICS EQUIPMENT Final Report
M. R. Davis, M. Kamins, and W. E. Mooz Jun. 1978 126 p refs
(Contract NAS2-9450)
(NASA-CR-152149; RAND/WN-10233-NASA) Avail: NTIS HC A07/MF A01 CSCL 01D

A methodology is provided for assisting NASA in estimating the cost, reliability, and maintenance (CRM) requirements for general avionics equipment operating in the 1980's. Practical problems of predicting these factors are examined. The usefulness and short comings of different approaches for modeling coast and reliability estimates are discussed together with special problems caused by the lack of historical data on the cost of maintaining general aviation avionics. Suggestions are offered on how NASA might proceed in assessing cost reliability CRM implications in the absence of reliable generalized predictive models. A.R.H.

N81-19112*# Sperry Flight Systems, Phoenix, Ariz.
V/STOL AND DIGITAL AVIONICS SYSTEM FOR UH-1H Final Report
Sam Liden Oct. 1978 216 p refs
(Contract NAS2-7306)
(NASA-CR-152179) Avail: NTIS HC A10/MF A01 CSCL 01D

A hardware and software system for the Bell UH-1H helicopter was developed that provides sophisticated navigation, guidance, control, display, and data acquisition capabilities for performing terminal area navigation, guidance and control research. Two Sperry 1819B general purpose digital computers were used. One contains the development software that performs all the specified system flight computations. The second computer is available to NASA for experimental programs that run simultaneously with the other computer programs and which may, at the push of a button, replace selected computer computations. Other features that provide research flexibility include keyboard selectable gains and parameters and software generated alphanumeric and CRT displays. T.M.

N81-19113# Boeing Military Airplane Development, Seattle, Wash. Advanced Airplane Branch.
INTEGRATED STRIKE AVIONICS STUDY, VOLUME 1 Final Report, 6 Aug. 1979 - 22 Sep. 1980
Harry R. Fox, G. L. Helser, F. M. Kim, R. L. Kinnaman, and M. R. Wallace Oct. 1980 225 p ref
(Contract F33615-79-C-1932)
(AD-A094705; D180-26023-1; AFWAL-TR-80-1145-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 19/5

This document reports the results of the integrated strike avionics study (ISAS). Advanced fire control concepts emphasizing the modular integration of current and emerging sensors and reduced crew workload were formulated and evaluated. A preferred system concept embodying the best features of the systems evaluated consisted of a Ku-SAR multimode radar, FLIR and Silicon TV EO sensors and a 3D Target Classifier. The mechanization was automatic with crewman participation. Post-autocuer/autoclassifier integration of sensors, manual-automatic mechanization of concepts, and improved terminal weapon guidance were recommended. GRA

N81-19114# Department of Transportation, Washington, D. C. Transportation Information Div.
GENERAL AVIATION AVIONICS STATISTICS Annual Report
Judith C. Schwenk, Paula Shafer, Preeti Pandit, and Wilson Hill (Wilson Hill Associates) Dec. 1980 125 p refs
(Contract DOT-TSC-1750)
(AD-A095148; FAA-MS-80-7; TSC-FAA-80-25) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report presents avionics statistics for the 1978 general aviation (GA) aircraft fleet and is the fifth in a series titled General Aviation Avionics Statistics. The statistics are presented in a capability group framework which enables one to relate airborne avionics equipment to the capability for a GA aircraft to function in the National Airspace System. The word 'capability' is used in this report to mean in what segments of the airspace an aircraft can fly, under what flight rules it can fly, and at what airports it can land. The framework permits the GA fleet to be divided into groups according to their capabilities as dictated by the avionics configurations of the aircraft. Differences in various characteristics of the aircraft are examined among the capability groups. The FAA's Sample File of results from the 1978 GA Activity and Avionics Survey is the source of all the statistical data used in this report. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-19115* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR SENSOR FAILURE DETECTION AND CORRECTION IN A GAS TURBINE ENGINE CONTROL SYSTEM Patent
Henry A. Spang, III (GE, Cincinnati) and Robert P. Wanger, inventors (to NASA) (GE, Cincinnati) Issued 3 Feb. 1981 14 p Filed 24 May 1978 Continuation in part of abandoned US Patent Appl. SN-752050, filed 20 Dec. 1976 Sponsored by NASA
(NASA-Case-LEW-12907-2; US-Patent-4,249,238; US-Patent-Appl-SN-909235; US-Patent-Appl-SN-752050; US-Patent-Class-364-106; US-Patent-Class-60-39.24; US-Patent-Class-364-431) Avail: US Patent and Trademark Office CSCL 21E

A gas turbine engine control system maintains a selected level of engine performance despite the failure or abnormal operation of one or more engine parameter sensors. The control system employs a continuously updated engine model which simulates engine performance and generates signals representing real time estimates of the engine parameter sensor signals. The estimate signals are transmitted to a control computational unit which utilizes them in lieu of the actual engine parameter sensor signals to control the operation of the engine. The estimate signals are also compared with the corresponding actual engine parameter sensor signals and the resulting difference signals are utilized to update the engine model. If a particular difference signal exceeds specific tolerance limits, the difference signal is inhibited from updating the model and a sensor failure indication is provided to the engine operator.

Official Gazette of the U.S. Patent and Trademark Office

N81-19116* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATED CONTROL SYSTEM FOR A GAS TURBINE ENGINE Patent
Jack E. Cornett (GE, Cincinnati), Andrew A. Saunders, Jr. (GE,

Cincinnati), Ira E. Marvin (GE, Cincinnati), and Richard S. Beitler, inventors (to NASA) (GE, Cincinnati) Issued 6 Jan. 1981 10 p Filed 25 May 1978 Continuation in part of abandoned US Patent Appl. SN-741056, filed 11 Nov. 1976 Sponsored by NASA
(NASA-Case-LEW-12594-2; US-Patent-4,242,864; US-Patent-Appl-SN-909608; US-Patent-Appl-SN-741056; US-Patent-Class-60-226R; US-Patent-Class-60-236; US-Patent-Class-60-238; US-Patent-Class-60-239) Avail: US Patent and Trademark Office CSCL 21E

A control system for a turbofan engine receives signals from a number of engine sensors and from the engine operator, and generates control signals. One control signal regulates the fan exhaust nozzle area in order to control inlet throat Mach number to maintain a low level of engine noise. Additional control signals regulate fuel flow to control engine thrust and fan pitch to control fan speed. A number of schedules are utilized to maintain a predetermined relationship between the controlled parameters and a number of fixed and calculated limits can override the control signals to prevent unsatisfactory engine performance.
Official Gazette of the U.S. Patent and Trademark Office

N81-19117*# AiResearch Mfg. Co., Phoenix, Ariz.
GENERAL AVIATION TURBINE ENGINE (GATE) STUDY Final Report
C. F. Baerst and D. G. Furst 5 Feb. 1979 274 p refs
(Contract NAS3-20755)
(NASA-CR-159482; AiResearch-21-2997) Avail: NTIS HC A12/MF A01 CSCL 21E

The feasibility of turbine engines for the smaller general aviation aircraft was investigated and a technology program for developing the necessary technology was identified. Major results included the definition of the 1988 general aviation market, the identification of turboprop and turboshaft engines that meet the requirements of the aircraft studies, a benefit analysis showing the superiority of gas turbine engines for portions of the market studied, and detailed plans for the development of the necessary technology. J.M.S.

N81-19118*# Detroit Diesel Allison, Indianapolis, Ind.
CERAMIC APPLICATIONS IN TURBINE ENGINES Semiannual Progress Report, 1 Jul. 1979 - 3 Dec. 1979
Michael S. Hudson, Michael A. Janovicz, and Franklin A. Rockwood May 1980 157 p refs
(Contracts DEN3-17; EC-77-A-31-1040)
(NASA-CR-159865; EDR-10156) Avail: NTIS HC A08/MF A01 CSCL 21E

Ceramic material characterization and testing of ceramic nozzle vanes, turbine tip shrouds, and regenerators disks at 36 C above the baseline engine TIT and the design, analysis, fabrication and development activities are described. The design of ceramic components for the next generation engine to be operated at 2070 F was completed. Coupons simulating the critical 2070 F rotor blade was hot spin tested for failure with sufficient margin to quality sintered silicon nitride and sintered silicon carbide, validating both the attachment design and finite element strength. Progress made in increasing strength, minimizing variability, and developing nondestructive evaluation techniques is reported.
E.A.K.

N81-19119*# AiResearch Mfg. Co., Phoenix, Ariz.
QCGAT MIXER COMPOUND EXHAUST SYSTEM DESIGN AND STATIC BIG MODEL TEST REPORT
W. L. Blackmore and C. E. Thompson 31 Oct. 1978 336 p refs
(Contract NAS3-20585)
(NASA-CR-135386; AiResearch-21-2861) Avail: NTIS HC A15/MF A01 CSCL 21E

A mixer exhaust system was designed to meet the proposed performance and exhaust jet noise goals for the AiResearch QCGAT engine. Some 0.35 scale models of the various nozzles were fabricated and aerodynamically and acoustically tested. Preliminary optimization, engine cycle matching, model test data and analysis are presented. A final mixer exhaust system is selected for optimum performance for the overall flight regime.
A.R.H.

N81-19120*# Avco Lycoming Div., Stratford, Conn.
DESIGN OF AN EXHAUST MIXER NOZZLE FOR THE AVCO-LYCOMING QUIET CLEAN GENERAL AVIATION TURBOFAN (QCGAT)
John F. Hurley, Leonard Anson, and Craig Wilson Aug. 1978 46 p refs
(Contract NAS3-20584)
(NASA-CR-159426; LYC-78-36) Avail: NTIS HC A03/MF A01 CSCL 21E

This report describes the design configuration and method used to design the forced engine exhaust to bypass air mixing system for Lycoming's QCGAT engine. This mixer is an integral part of the total engine and nacelle system and was configured to reduce the propulsion system noise and fuel consumption levels. Author

N81-19121*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTRAL FLAME RADIANCE FROM A TUBULAR-CAN COMBUSTOR
Russell W. Claus Feb. 1981 15 p refs
(NASA-TP-1722; E-509) Avail: NTIS HC A02/MF A01 CSCL 21E

An experimental investigation was conducted to determine the effects of fuel type, fuel-air ratio, and inlet-air pressure on the spectral flame radiance emanating from a JT8D can combustor. Spectral radiance measurements from 1.55 to 5.5 micrometers of wavelength were recorded and analyzed to determine soot concentration and flame temperature at various axial locations in the combustor. Two fuels differing in volatility, viscosity, and chemical composition were used in this investigation. Author

N81-19122*# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
MEASUREMENTS OF AERODYNAMIC DAMPING IN THE MIT TRANSONIC ROTOR
Edward F. Crawley Feb. 1981 123 p refs
(Grant NsG-3079)
(NASA-CR-163988; GTL-157) Avail: NTIS HC A06/MF A01 CSCL 21E

A method was developed and demonstrated for the direct measurement of aerodynamic forcing and aerodynamic damping of a transonic compressor. The method is based on the inverse solution of the structural dynamic equations of motion of the blade disk system in order to determine the forces acting on the system. The disturbing and damping forces acting on a given blade are determined if the equations of motion are expressed in individual blade coordinates. If the structural dynamic equations are transformed to multiblade coordinates, the damping can be measured for blade disk modes, and related to a reeuced frequency and interblade phase angle. In order to measure the aerodynamic damping in this way, the free response to a known excitation is studied. Author

N81-19123# Avco Lycoming Div., Stratford, Conn.
REGENERATIVE ENGINE ANALYSIS PROGRAM Final Study Report, Oct. 1979 - Jul. 1980
P. Schwaar, J. Dale, and J. Banks Jan. 1981 199 p refs
(Contract DAAK51-79-C-0056; DA Proj. 1L1-62209-AH-76)
(AD-A095144; LYC-80-73) Avail: NTIS HC A09/MF A01 CSCL 21/5

A parametric cycle analysis and a preliminary recuperator design study were conducted for a 500 hp intermediate rated power (IRP) recuperative helicopter engine. The U-tube recuperator with airflow inside the tubes and single cross flow gas path was found to be the lightest design in the .6 - .8 effectiveness range considered for the cycle analysis. GRA

N81-19124# Pennsylvania State Univ., University Park. Applied Research Lab.
COUPLING OF UNSTEADY LIFT TO ACOUSTIC DUCT MODES IN AN AXIAL FLOW FAN
C. S. Lee 15 Sep. 1980 135 p refs
(Contract N00024-79-C-6043)
(AD-A095080; ARL/PSU/TM-80-188) Avail: NTIS HC A07/MF A01 CSCL 21/5

By using distortion screens, plane (0,0) and spinning (-1,0) acoustic modes were generated in an axial flow research fan.

The unsteady lift on the rotor blade and the acoustic pressure along the duct were measured simultaneously by a lift gage sensor and a flush-mounted microphone respectively. The screens were calibrated by circumferentially traversing a five-hole probe. The typical background noise of unsteady lift and acoustic pressure was well below the desired signals. A phase-locked ensemble averaging technique was used to obtain the amplitude and phase of the periodic unsteady signals. The measured acoustic pressures were decomposed into modal pressures and compared with theoretical prediction; a reasonable trend was reached, but the discrepancies were large. The unsteady lift measurements of (-1,0) mode generation agreed with predictions except near the cutoff frequency indicating a back-reaction effect of considerable magnitude. The predictions overestimated the unsteady lift for the condition of 'aerodynamic resonance' when the plane wave was generated. GRA

N81-19125# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

BACKUP CONTROL FOR A VARIABLE CYCLE ENGINE Final Technical Report, 1 Sep. 1977 - 16 Apr. 1979

Howard B. Kast Jul. 1980 130 p refs

(Contract F33615-76-C-2086; AF Proj. 3066)

(AD-A094730; R80AEG450; AFAPL-TR-79-2069) Avail: NTIS HC A07/MF A01 CSCL 21/5

The next generation of variable cycle aircraft engines (VCE) will have an increased complexity associated with the number of controlled engine variables, inherent cycle variability, and inlet-engine-exhaust control integration. This level of engine complexity and the expanding integration of aircraft/engine controls causes a commensurate increase in the control system complexity and capacity. Digital electronics has been identified as the only viable means for meeting these significantly more sophisticated requirements of the future VCE. Although recent digital electronic advances promise new levels of reliability, this improvement is offset by the increased circuitry of the more complex control. Especially in the case of the single-engine aircraft, it is recognized that such variable cycle engines should be equipped with a Backup Control for emergency use. The recommended hydromechanical approach has been constructed, calibrated and evaluated in a test cell. These evaluations included transient operation and transfer form the primary control to the backup control and back to primary operation. Successful operation was achieved, providing test hardware which is intended for further validation through on-engine testing. GRA

N81-19126# Rolls-Royce Ltd., Derby (England).

ON THE INFLUENCE OF STEADY STATE TEMPERATURE AND PRESSURE DISTORTION ON THE FLOW CHARACTERISTICS IN AN INSTALLED MULTISTAGE JET ENGINE COMPRESSOR

Hermann Kuenkler (Technische Hochschule, Aachen) and Hans Toenskoetter (Technische Hochschule, Aachen) 1980 32 p refs Transl. into ENGLISH from Z. Flugwiss. Weltraumforsch. 3, v. 6, 1979 p 360-378

(Contract DFG-SFB-38)

(PNR-90022; Trans-15068) Avail: NTIS HC A03/MF A01

An experimental determination of the local variation of flow fields due to steady state circular distortion in a multistage jet engine compressor was made, taking into account the operating conditions and restraints of the complete turbine engine interaction. To simulate disturbances a four quadrant intake section was placed before the engine (a single shaft ATAR). Temperature disturbances were produced by mixing hot air into the intake flow. A qualititative analysis was made in advance on the effects of the disturbances on the flow characteristics considering the interaction between the disturbed and undisturbed compressor flow. With this prediction and by use of computer aided test methods it is possible to significantly reduce the complexity of the test and the test equipment facilities. Author (ESA)

N81-19127# Rolls-Royce Ltd., Derby (England).

THE CALCULATION OF QUASI-THREE-DIMENSIONAL FRICTIONLESS COMPRESSIBLE FLOW IN AXIAL TURBOMACHINES

S. Biniaris 1980 14 p Transl. into ENGLISH from VDI Ber., No. 193, 1973

(PNR-90047; Trans-15292) Avail: NTIS HC A02/MF A01

A method of calculating quasi-three dimensional frictionless flow in axial turbomachines is presented. The flow field is calculated not only in the bladeless spaces but also within the rows of blades. The compressibility, the blade forces and the blade thickness are taken into account. A finite difference method, an extension of earlier work with which initially the quasi-three dimensional flow could only be calculated within a stationary or rotating row of blades is used. As calculation examples, the flow parameters in the complete field of three axial turbine stages are given. Author (ESA)

N81-19128# Elektroschmelzwerk Kempten G.m.b.H., Munich (West Germany).

DEVELOPMENT AND FABRICATION OF REFRACTORY SILICON CARBIDE BODIES, ESPECIALLY FOR GAS TURBINE ENGINES Final Report

Jochen Kriegesmann, Alfred Lipp, Klaus Reinmuth, Karl A. Schwetz, and Detlef vonStruensee Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 42 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-137; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

The production parameters and the properties of hot pressed silicon carbide forms were investigated. Both alpha and beta silicon carbide powders were used as starting materials for hot pressing. Hot pressed silicon carbide parts, especially rotors used in gas turbine engines, were examined by thermoshock and spin testing. Results show that the properties of the resulting forms, especially the high temperature strength and fracture behavior, strongly depend upon the kind and the quantity of the sintering powder. Regardless which silicon carbide powder is used, precompacted and presintered silicon carbide parts are further densified by hot isostatic pressing. Author (ESA)

N81-19129# Annawerk Keramische Betriebe G.m.b.H., Roedental (West Germany). Bereich Ceranox.

DEVELOPMENT OF GAS TURBINE COMPONENTS, USING SILICON NITRIDE Final Report

Ernst Gugel, Norbert Mueller, Albrecht Fickel, Heinz Kessel, Gerhard Leimer, Hans Lindner, Antonin Novotny, Isfried Petzenhauser, Detlef Steinmann (Degussa), Adam Both (Degussa) et al Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 109 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-152; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

Ceramic, gas turbine component development is described. Designs comprehend working temperatures up to 1350 C. Both reaction sintering (RS) and hot pressing (HP) of silicon nitride materials are considered. OF all molding methods examined, injection molding and slip casting for RS components and axial as well as quasi-isostatic hot pressing for HP components prove most successful. As to compounding technology, the post-hot pressing technique is shown very promising. A large number of molded parts, i.e., turbine blades, blade rings, nose cones, flame tubes, and HP/RS rotor prestages, were produced and successfully tested. Spin speeds of 69,000 rpm for the RS turbine blades and 110,000 rpm for an HP rotor hub are reported. A large number of special testing methods were developed and are described in reference to their application. Results show that bending strength is increased for RS and HP silicon nitride parts up to values of > or equal 250 N/sq mm and > or equal 700 N/sq mm, respectively. Creep stability is also satisfactory. Author (ESA)

N81-19013*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ADVANCED TURBOPROP INSTALLATION AERODYNAMICS

R. C. Smith *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 171-181 refs (For primary document see N81-19001 10-01)

Avail: NTIS HC A09/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-19130* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THRUST AUGMENTED SPIN RECOVERY DEVICE Patent
Bobby L. Berrier, inventor (to NASA) Issued 2 Dec. 1980 6 p Filed 27 Apr. 1979 Supersedes N80-18048 (18 - 09, p 1095) Continuation of US Patent Appl. SN-272503, filed 28 Sep. 1976
(NASA-Case-LAR-11970-2; US-Patent-4,236,684; US-Patent-Appl-SN-034104; US-Patent-Appl-SN-727503; US-Patent-Class-244-52; US-Patent-Class-244-87; US-Patent-Class-244-12.5) Avail: US Patent and Trademark Office CSCL 01C

Yaw control surfaces were developed for a jet propelled aircraft. A thrust augmented rudder is disposed above the jet exhaust stream and a thrust rudder tab extends downward into the jet exhaust stream. These components are cooperatively deflected to generate yawing moments for directional control of the aircraft. T.M.

N81-19131*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT-TEST EVALUATION OF STOL CONTROL AND FLIGHT DIRECTOR CONCEPTS IN A POWERED-LIFT AIRCRAFT FLYING CURVED DECELERATING APPROACHES
W. S. Hindson (National Research Council of Canada, Ottawa, Ontario), G. H. Hardy, and R. C. Innis Mar. 1981 96 p refs (NASA-TP-1641; A-8190) Avail: NTIS HC A05/MF A01 CSCL 01C

Flight tests were carried out to assess the feasibility of piloted steep curved, and decelerating approach profiles in powered lift STOL aircraft. Several STOL control concepts representative of a variety of aircraft were evaluated in conjunction with suitably designed flight directions. The tests were carried out in a real navigation environment, employed special electronic cockpit displays, and included the development of the performance achieved and the control utilization involved in flying 180 deg turning, descending, and decelerating approach profiles to landing. The results suggest that such moderately complex piloted instrument approaches may indeed be feasible from a pilot acceptance point of view, given an acceptable navigation environment. Systems with the capability of those used in this experiment can provide the potential of achieving instrument operations on curved, descending, and decelerating landing approaches to weather minima corresponding to CTOL Category 2 criteria, while also providing a means of realizing more efficient operations during visual flight conditions. Author

N81-19132*# National Aeronautics and Space Administration, Washington, D. C.
A BRIEF ANALYSIS AND ITS EXPERIMENT OF THE HYDRAULIC-ELECTRIC LOADING SERVOSYSTEM
Ma Liango-fu Dec. 1980 23 p refs Transl. into ENGLISH of Rept. HK80071, Aug. 1980 p 1-21 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Chinese Aeronautical Establishment, Beijing
(Contract NASw-3199)
(NASA-TM-76458; HK80071) Avail: NTIS HC A02/MF A01 CSCL 01C

The servosystem is a force simulator. It can be used to simulate the hinge moment of the control surface for aircraft, and still be a stick force generator. According to the experiences of a real system, theoretical analyses of the loading system and its characteristics were performed and the possibility of improving its performances is discussed. T.M.

N81-19133# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Advanced Aircraft Navigation Section.
ESTIMATION AND STATISTICAL AVERAGING APPLIED TO REDUNDANT STRAPPED DOWN INERTIAL SENSORS FOR NAVIGATION AND FLIGHT CONTROL Final Report, 1 Aug. 1978 - 1 Feb. 1980
Jack W. Bell Sep. 1980 143 p refs
(AF Proj. 666A)
(AD-A094465; AFWAL-TR-80-1088) Avail: NTIS HC A07/MF A01 CSCL 17/7

The concept of providing inertial data to satisfy on-board avionic functions from an integrated, strapped down, redundant inertial sensor reference system is presently receiving attention for military and commercial aircraft applications. Strapped down inertial sensors are well suited for flight control. However, in the highly dynamic environment of high performance aircraft, the present accuracy provided by strapped down inertial reference systems (IRS) is insufficient to meet navigation and weapon delivery requirements. Performance improvement of an IRS employing redundant strapped down inertial sensors of specified ensemble is the subject of this study. Two techniques to improve the performance are considered. One technique is to combine all redundant data from non-failed sensors, through a statistical average, into a orthogonal triad inertial reference frame. This is accomplished by weighted-least-squares averaging. A second technique is the use of an improved gyro and accelerometer output and output rate estimation scheme. Estimation algorithms are developed using Kalman Filter theory and evaluated in a highly dynamic environment. Least-squares averaging of the redundant sensor data can significantly improve the navigation system performance. However, sensor misalignment errors must be minimized such that they are not the dominant sensor error source. GRA

N81-19134# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
DESIGN AND TEST OF A HYDRA-OPTIC FLIGHT CONTROL ACTUATION SYSTEM (HOFCAS) CONCEPT Final Report, 18 Sep. 1979 - 17 Dec. 1980
Lloyd L. Kohnhorst and Domenic A. Magnacca Dec. 1980 113 p
(Contract N62269-79-C-0709)
(AD-A094688; NR80H-87; NADC-79156-60) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report describes the development, testing and demonstration of a Hydra-Optic Flight Control Actuation System (HOFCAS) suitable for the actuation tasks of a Digital Fly-By-Wire flight control system. HOFCAS offers a realistic, cost effective approach to reducing the susceptibility of aircraft fly-by-wire systems to EMP, EMI, RFI, lightning, etc. By removing the conventional wiring to the actuation areas of an aircraft, the concept eliminates the opportunity for electromagnetic hazards to enter the system. The HOFCAS concept provides a direct drive, hydraulically powered surface actuation system that provides immunity to electromagnetic radiation. The direct drive actuator, developed in a previous multiphase Navy Advanced Flight Control Actuation System (AFCAS) program, uses an electrical torque motor to power a single stage hydraulic valve for control of the actuator. A hydraulically powered alternator supplies the electrical power needed to operate the torque motor. The actuator command signal is supplied by a fiber optic link. The HOFCAS was configured to operate the directional control system in a T-2C aircraft. The AFCAS program demonstrated direct digital control of a surface actuator, and the HOFCAS extends this technology to demonstrate that conventional interconnecting electrical wiring to the surface actuators can be eliminated. GRA

N81-19135# European Space Agency, Paris (France).
IN-FLIGHT HANDLING QUALITIES INVESTIGATION OF A310 AIRBUS DLC-CONFIGURATIONS ON LANDING APPROACH, USING THE DFVLR-HFB 320 IN-FLIGHT SIMULATOR (VARIABLE STABILITY AIRCRAFT)
Dietrich Hanke Nov. 1980 85 p refs Transl. into ENGLISH of Fliegbarkeitsuntersuchung von DLC-Konfigurationen fuer den Airbus A310 im Landeanflug mit dem In-Flight-Simulator DFVLR-HFB 320, DFVLR, Brunswick, Rept. DFVLR-FB-79-18, Feb. 1979 Original report in GERMAN previously announced as N81-10078
(ESA-TT-630; DFVLR-FB-79-18) Avail: NTIS HC A05/MF A01

The in-flight simulation of the longitudinal and lateral/directional dynamics of the planned Airbus A310 aircraft using the DFVLR-HFB 320 variable stability aircraft is described.

Emphasis is on the evaluation of different spoiler direct lift control (DLC) concepts for longitudinal control. The invluence of these concepts on handling qualities and pilot vehicle performance under real ILS approach environmental conditions is determined. Two pilots flew 63 ILS approaches evaluating four aircraft/DLC configurations. The flight path to pitch attitude phase is found to be the main handling quality parameter for DLC enhanced longitudinal control. A generally applicable flight path to pitch attitude phase criterion is proposed. Author (ESA)

N81-19002*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY RESEARCH CENTER CONTRIBUTIONS IN ADVANCING ACTIVE CONTROL TECHNOLOGY
I. Abel and J. R. Newsom *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 1-19 refs (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19006*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
GROUND AND FLIGHT TEST EXPERIENCE WITH A TRIPLE REDUNDANT DIGITAL FLY BY WIRE CONTROL SYSTEM
Calvin R. Jarvis and Kenneth J. Szalai *In* NASA. Langley Research Center Advan. Aerodyn. and Active Controls Feb. 1981 p 67-84 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

N81-19009*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE EET HORIZONTAL TAILS INVESTIGATION AND THE EET LATERAL CONTROLS INVESTIGATION Status Report
Peter F. Jacobs and Dennis W. Bartlett *In its* Advan. Aerodyn. and Active Controls Feb. 1981 p 123-133 (For primary document see N81-19001 10-01)
Avail: NTIS HC A09/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N81-19136*# Systems Control, Inc., Palo Alto, Calif.
SIMULATION AND CONTROL ENGINEERING STUDIES OF NASA-AMES 40 FOOT BY 80 FOOT/80 FOOT BY 120 FOOT WIND TUNNELS Final Report, Aug. 1977 - Mar. 1978
Jeff G. Bohn and J. Edwin Jones 26 May 1978 316 p refs (Contract NAS2-9665)
(NASA-CR-152145) Avail: NTIS HC A14/MF A01 CSCL 14B

The development and use of a digital computer simulation of the proposed wind tunnel facility is described. The feasibility of automatic control of wind tunnel airspeed and other parameters was examined. Specifications and implementation recommendations for a computer based automatic control and monitoring system are presented. T.M.

N81-19137*# National Aeronautics and Space Administration, Washington, D. C.
ROTATIVE BALANCE OF THE I.M.F. LILLE AND ASSOCIATED EXPERIMENTAL TECHNIQUES
R. Verbrugge Jan. 1981 51 p Transl. into ENGLISH of "Balance rotative de l'I.M.F. Lille et techniques experimentales associees" AAAF Paper NT 80-13 Lille, 1979 50 p Presented at the 16th Colloq. Aerodyn. Appl., Lille, 13-15 Nov. 1979 Original language document was announced as A80-36844 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. de Mecanique des Fluides de Lille
(Contract NASw-3199)
(NASA-TM-75886) Avail: NTIS HC A04/MF A01 CSCL 14B

The study of aerodynamic effects at high incidence associated with motions of wide amplitude incorporating continuous rotations requires the consideration of coupled effects, which are generally nonlinear, in a formulation of equations of motion. A rotative balance designed to simulate such maneuvers in a windtunnel was created to form a test medium for analytical studies. A general description of the assembly is provided by considering two main ranges of application. The capacities and performance of the assembly are discussed. T.M.

N81-19138*# National Aeronautics and Space Administration, Washington, D. C.
QUALITATIVE STUDY OF THE APPEARANCE OF NITROGEN FOG IN THE CRYOGENIC WIND TUNNEL AT T PRIME 2 INDUCTION
M. Dinguirard, G. Serrot, J. Duffaut, A. Blanchard, J. B. Dor, and J. F. Breit Aug. 1980 64 p refs Transl. into ENGLISH of "Etude Qualitative de Apparition du Induction T prime 2", Toulouse, Report 1/6059, Feb. 1980 73 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75857) Avail: NTIS HC A04/MF A01 CSCL 14B

A device for parietal liquid injection carried out at high velocity immediately after the U bend of the air injector of the cryogenic wind tunnel at induction T2 was implemented in order to decrease thermal turbulence and the number of droplets of residual nitrogen at the level of the test threshold thanks to fine atomization of nitrogen. A significant number of particles were observed in the discharge when its temperature is below a certain level which is in the actual conditions of T2 from 130 to 140 K. T.M.

N81-19139*# National Aeronautics and Space Administration, Washington, D. C.
FIRST RESULTS OBTAINED BY THE AMD-BA COMPANY FROM THE ROTARY ASSEMBLY OF THE AMF LILLE
C. Couedor Jan. 1981 21 p Transl. into ENGLISH of conf. paper presented at the 16th Colloq. d'Aerodyn. Appl. p 1-21 Colloq. held in Lille, France, 13-15 Nov. 1979 Original language document was announced as A80-36845 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75887) Avail: NTIS HC A02/MF A01 CSCL 14B

Efforts were made to extend flight range of combat airplanes to high incidences. The static and dynamic results obtained on a modern combat airplane with data wings are presented. R.C.T.

N81-19140# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
THE PROBLEMS WITH THE INTERFACE SYSTEM OF THE VISUAL SIMULATOR AS A CAUSE OF PILOT INDUCED OSCILLATIONS (PIO'S) IN FLIGHT SIMULATORS [PROBLEME DER SIMULATOR-/SICHTSYSTEM-NAHTSTELLE ALS URSACHE FUER PILOT-INDUCED OSCILLATIONS (PIO'S) IN FLUGSIMULATOREN]
P. Koenig and W. Metze 4 Mar. 1980 18 p refs In GERMAN
(MBB-UA-528-80-Oe) Avail: NTIS HC A02/MF A01

Regulations on technical aspects of pilot induced oscillations inflight simulators are discussed. The problems in the system implementation are the experience of integration from the visual simulator into the MRCA training simulation. Technical conditions and solutions to solve the problem are presented.
Transl. by E.A.K.

N81-19141# Honeywell Systems and Research Center, Minneapolis, Minn.
REAL-TIME FEASIBILITY FOR GENERATION OF NONLINEAR TEXTURED TERRAIN Final Report
Duane Soland, Mark Voth, and Pat M. Narendra AFSC Brooks AFB, Texas Jan. 1981 115 p
(Contract F33615-77-C-0073; AF Proj. 1958)
(AD-A095070; AFHRL-TR-79-27) Avail: NTIS HC A06/MF A01 CSCL 14/2

This study was conducted by Honeywell for the Air Force Human Resources Laboratory (AFHRL) in order to evaluate and study a potential new approach for the simulation of visual and

sensor imagery for Air Force training applications. This report describes the hardware implementation of a curved-surface method for computer image generation (CIG) of textured terrain imagery. General comments and details of the algorithms are presented. This is followed by a discussion of the hardware required for a real-time implementation of this technique. The approach involves the display of terrain as curved surfaces represented by bicubic splines. Texture patterns may then be mapped to these terrain surfaces. Buildings or man-made features may be drawn using polygonal surfaces. This curved approach is of interest because it may represent a more cost-effective method to include more detail in the simulated imagery. Current systems are constrained to the use of straight edges in the representation of real-world features and require large numbers of edges to display complex, irregular objects such as terrain. Therefore, the curved surface approach may demonstrate many advantages over the straight edge technique. GRA

N81-19142# ARO, Inc., Arnold Air Force Station, Tenn.
EFFECTS OF WINDOW CONFIGURATION ON MODEL PRESSURE DISTRIBUTION IN WIND TUNNELS WITH PERFORATED WALLS Final Report, Oct. 1978 - Sep. 1979
F. L. Heltsley AEDC Jan. 1981 59 p refs
(AD-A094213; AEDC-TR-80-1) Avail: NTIS HC A04/MF A01 CSCL 14/2

Larger optical windows for access to the model flow field in the Arnold Engineering Development Center (AEDC) transonic wind tunnels will be required for optimum utilization of the laser velocimeter (LV). A combined analytical and experimental investigation was performed to assess the effects of such windows upon the performance of the perforated walls. The experimental results from the Aerodynamic Wind Tunnel (1T) indicate that although the wall interference characteristics of some window configurations approach the standard porous wall, none of the configurations tested exhibited adequate wave cancellation for all Mach numbers from M at infinity = 1.0 through 1.4. A variable porosity wall arrangement is described which appears to be capable of providing acceptable optical access without adversely affecting the tunnel flow field. GRA

N81-19143# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VALIDATION OF THE WRIGHT-PATTERSON VERTICAL WIND TUNNEL M.S. Thesis
James W. Hickman Dec. 1980 56 p refs
(AD-A094777; AFIT/GAE/AA/80D-10) Avail: NTIS HC A04/MF A01 CSCL 14/2

A spin capability evaluation of the Wright-Patterson vertical wind tunnel was completed using a model of the Bell X-5. The X-5 model was previously spin tested in the NASA vertical wind tunnel at Langley AFB, Va. The study compared results obtained at the NASA-Langley vertical wind tunnel with the test results obtained at the Wright-Patterson vertical wind tunnel. The Langley results were used as the basis for this evaluation. Information was available on spin characteristics of the model with respect to various control surface configurations and recovery attempts using control deflections. The spin tests revealed a stable equilibrium spin and recovery, where applicable, could be established and observed for each corresponding stable equilibrium spin and recovery that was observed at Langley. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-19144*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLOAT ZONE WORKSHOP
Robert J. Naumann Dec. 1980 175 p refs Workshop held in Huntsville, Ala., 12 Dec. 1980
(NASA-CP-2179) Avail: NTIS HC A08/MF A01 CSCL 22A

A summary of the Analytical Float Zone Experiment System (AFZES) concept is presented. The types of experiments considered for such a facility are discussed. Reports from various industrial producers and users of float zone material are presented. Special emphasis is placed on state-of-the-art developments in low gravity manufacturing and their applications to space processing. For individual titles, see N81-19145 through N81-19156.

N81-19145*# Little (Arthur D.), Inc., Cambridge, Mass.
SCIENCE REQUIREMENTS WORKING GROUP (SRWG) IN FLOAT ZONE MATERIALS PROCESSING IN SPACE: A REVIEW
Arthur A. Fowle *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 5-10 (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

A summary and history of the Float Zone Working Group was presented. The functions of this working group are to: provide an informal forum of scientific investigators for the exchange of information and ideas in the approach of the solution of common problems in float zone processing, help plan the research and development necessary to place the float zone process on a firm base of scientific understanding and advanced technological development, establish the science requirements for the AFZES for Spacelab, and seek ways to maximize the advantages of the space environment in the pursuit of these goals. T.M.

N81-19146*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemical Engineering.
SURFACE TENSION-DRIVEN CONVECTION PHENOMENA
J. Adin Mann, Jr. *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 11-21 refs (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The techniques for measuring surface tension-driven flow are reported. In addition to the fairly standard crossed beam LDV method, methods using ripplon scattering which do not require seeding of the fluid were developed. These methods can be used to determine thermophysical properties of the surface, such as surface tension, viscosity, and local temperature. This technique was utilized to observe the change in surface tension associated with the nematic to isotropic phase transition of para-azoxydianisole at 134 C. The ripplon scattering methods become difficult for surface velocities below 1 mm/sec because of the overlapping spectra. Careful analysis procedures could extend this to smaller flows, but the more conventional LDV techniques with seeded flows are the method of choice for slow flows. T.M.

N81-19147*# Case Western Reserve Univ., Cleveland, Ohio.
SURFACE TENSION-DRIVEN CONVECTIONS
Simon Ostrach *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 22-35 refs (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The study of time-dependent flows generated by surface-tension gradients in thin liquid layers is reported. Numerical techniques for dealing with the complete float-zone process were investigated. In particular, finite element methods with fast iterative procedures, using multipoint constraints and nonlinear optimization were examined. T.M.

N81-19148*# Iowa State Univ. of Science and Technology, Ames.
FLOAT ZONE EXPERIMENTS
John Verhoeven *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 36-48 (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The objectives of this work are: to determine if surface tension-driven convection in float zone experiments may be controlled by means of surface films; and if convection can be controlled, determine whether homogeneous solute distributions will be achieved in float zone solidification and whether accurate measurements of liquid diffusion coefficients may be obtained from float zone solidification experiments. Sn was chosen as a model material because it is a group IV element, chemically similar to Si and Ge and its low melting point and low vapor pressure allow Auger spectroscopy to be employed with liquid samples. T.M.

N81-19149*# Stanford Univ., Calif. Dept. of Chemical Engineering.
THERMOCAPILLARY FLOWS AND THEIR STABILITY
Steve Davis (Northwestern Univ.) and George Homsy *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 49-54 refs (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

Steady convective flows for geometries of varying complexity are described. This in general involves the solution of nonlinear free boundary problems. The stability of these flows were determined to more complicated (perhaps time dependent) modes of fluid motion. These include shear flow and free surface instability modes, with possible coupling between them. The effect of surface chemical species is described, including impurities which act as surfactants and insoluble oxide films, on the convective patterns and their stability. T.M.

N81-19150*# Hughes Aircraft Co., Carlsbad, Calif.
FLOAT ZONE SILICON FOR IR DETECTORS
E. L. Kern *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 57-72 (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

An overview of the state of the art of processing silicon for use as infrared detectors is presented. Improvements in the process that could be obtained in a low-g environment were examined. The various requirements for the different types of Si detector materials are summarized. T.M.

N81-19151*# Westech Systems, Inc., Phoenix, Ariz.
FLOAT ZONE REFINING: SPACE PROBLEMS AND SOLUTIONS. A SPECULATIVE PROPOSAL
Gerald Gill *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 73-74 (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

A facility for the automatic growth of 60 cm long boules of Si up to 10 cm diameter is described. The facility is 21 ft tall, weighs 17,000 lb (without the sand ballast), and consumes 60 kW power. As a point of reference, the facility will cost approximately $500K without automation which will be developed. The total price is expected to be approximately $1.2 million. T.M.

N81-19152*# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PRACTICAL ASPECTS OF SILICON FLOAT ZONE CRYSTAL GROWTH
Ted T. Ciszek *In* NASA. Marshall Space Flight Center Float Zone Workship Dec. 1980 p 75-77 (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The float zone (FZ) growth method for silicon crystallization has advantages and disadvantages when compared to the other principal growth method, the Czochralski (CZ) technique. CZ growth is attractive for the following reasons: large diameters, high single crystal yields, low thermal gradients, low operator skill requirements, efficient power utilization, and low feed material costs. Some areas where FZ growth is advantageous include high purity, axial resistivity uniformity (on a macroscale), visibility of the growth region, low consumable material costs, and high growth rates. T.M.

N81-19153*# Monsanto Co., St. Peters, Mo.
FUTURE FLOAT ZONE DEVELOPMENT IN INDUSTRY
Robert M. Sandfort *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 78-85 ref (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The present industrial requirements for float zone silicon are summarized. Developments desired by the industry in the future are reported. The five most significant problems faced today by the float zone crystal growth method in industry are discussed. They are economic, large diameter, resistivity uniformity, control of carbon, and swirl defects. T.M.

N81-19154*# Rocketdyne, Canoga Park, Calif.
PROBLEMS WITH STATE-OF-THE-ART FLOAT ZONE SILICON
Lubick Jastrzebski *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 86-92 (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

An application in which CCD optical imaging arrays with 250,000 elements are fabricated from the best commercially available float zone Si is described. Two image defects are described which appear to be related to the starting material. The striation effect appears to be caused by resistivity and recombination center variations. Up to 30 percent variations in resistivity was measured across a sample. T.M.

N81-19155*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemical Engineering.
RIPPLON SCATTERING USING GRATING HETERODYNE SPECTROSCOPY
R. S. Sirohi (Indian Inst. of Technology, Madras), R. V. Edwards, and J. Adin Mann, Jr. *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 98-135 refs (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

Heterodyne photon spectroscopy was used for the study of the visco-elastic properties of the liquid interface by studying the scattering from thermal ripplons. A theory of a heterodyne apparatus based on a grating is presented, and the heterodyne condition is given in terms of the parameters of the experimental set-up. Emphasis was placed on the study of the instrumental function and its influence on the measurement data. The instrumental function is not always gaussian, but its functional form depends on the parameters of the experimental set-up. An algorithm is suggested to arrive at the center frequency and half width at half height of the spectrum from the noisy experimental data, and applied to the measurement data obtained from ethanol and water surfaces. T.M.

N81-19156*# Case Western Reserve Univ., Cleveland, Ohio. Department of Chemical Engineering.
MEASUREMENT OF SURFACE FLOW VELOCITY WITH RIPPLON SCATTERING
R. S. Sirohi (Indian Inst. of Technology, Madras), R. V. Edwards, and J. Adin Mann, Jr. *In* NASA. Marshall Space Flight Center Float Zone Workshop Dec. 1980 p 136-169 refs (For primary document see N81-19144 10-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

It was shown that the light scattered from the ripplons on a moving liquid interface can be used to measure the velocity fields in the interface. The technique measures the true interface velocity. It is, however, limited to the measurement of relatively fast moving interfaces because the scattered irradiance is large only in a very small angular range about the specularly reflected beam, and the concerted influence of instrumental and natural broadening of the power spectrum leads to severely overlapping doublet for low velocity fields. T.M.

N81-19157*# General Electric Co., Philadelphia, Pa. Space Div.
AUTOMATED DIRECTIONAL SOLIDIFICATION SYSTEM FOR SPACE PROCESSING Final Report, 30 Jun. 1975 - 31 Jan. 1981
Louis R. McCreight, comp. Jan. 1981 13 p refs
(Contract NAS8-31536)
(NASA-CR-161700) Avail: NTIS HC A02/MF A01 CSCL 22A

The system is to be used under low gravity conditions aboard a sounding rocket. Two complete flight qualified units, each of which includes four individually controllable furnaces capable of operation to as high as 1600 C, were developed with operating and control panels, associated cables, tools, and some spare supplies. Drawings, operating manuals, a user's computer program and reports and papers describing the work and equipment are presented. T.M.

N81-19158*# National Aeronautics and Space Administration, Washington, D. C.
NEWS OF BRAZILIAN SPACE ACTIVITIES
Aug. 1980 36 p Transl. into ENGLISH from Espacial (Brazil), v. 7, no. 35, Aug. 1979 p 1-8 Transl. by Kanner (Leo) Associates,

Redwood City, Calif. Original doc. prep. by Inst. de Pesquisas Espaciais, Sao Jose dos Campos, Brazil
(Contract NASw-3199)
(NASA-TM-76303) Avail: NTIS HC A03/MF A01 CSCL 22A

Remote sensing and meteorological observations of satellites are covered. Development of an oceanographic atlas, prediction of droughts, and results of geological surveys using satellite data are discussed. J.M.S.

N81-19159# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
SPACE ACTIVITY IN NORWAY, 1979
Arne Gundersen 1979 37 p refs Presented at 23rd COSPAR Plenary Meeting, Budapest, 9-14 Jun. 1980
(SAD-81-T; ISBN-82-7224-031-9) Avail: NTIS HC A03/MF A01

The Andoeya rocket range, Tromso Telemetry station, EISCAT, HEATING, PRE, and STARE facilities are described. Space research programs which are discussed include sounding rocket projects, satellite projects, balloon projects and ground based projects. Author (ESA)

N81-19160# Swedish Board for Space Activities, Stockholm.
SPACE RESEARCH IN SWEDEN, 1979
1980 39 p refs Presented at 23rd COSPAR Meeting, Budapest, 9-14 Jun. 1980
Avail: NTIS HC A03/MF A01

The organizational structure and research facilities used for various scientific programs are described. Advancements and planned research is summarized for the following areas: spaceborne experiments; balloon, aircraft, and rocket sounding; atmospheric physics; astronomy; liquid metals and metal casting; telemetry and data acquisition systems; remote sensing of Earth resources; meteorology, and communications. A.R.H.

N81-19161# Deutsche Forschungsgemeinschaft, Bad Godesberg (West Germany).
SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY, 1979 Annual Report
1980 66 p refs
Avail: NTIS HC A04/MF A01

Activities in aeronomy, ionospheric and magnetospheric physics are described. Studies of solar radiation and the solar wind, the atmosphere of Venus, micrometeorites and cosmic dust are outlined. Research was conducted in stellar astronomy, the life sciences, materials sciences, satellite geodesy and meteorology. Ground truth measurements were conducted. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-19162# Harry Diamond Labs., Adelphi, Md.
SELECTION OF AN OPTICAL FIBER FOR THE RADIATION ENVIRONMENT OF THE SATELLITE X-RAY TEST FACILITY
Timothy R. Oldham, James C. Blackburn, and Raine M. Gilbert Jul. 1980 20 p refs
(AD-A094835; HDL-TM-80-22) Avail: NTIS HC A02/MF A01 CSCL 14/2

The pulsed radiation environment of the proposed Satellite X-Ray Test Facility (SXTF) consists of synchronized pulses of low-energy plasma radiation and bremsstrahlung produced by 150-keV electrons. In addition, there is also a low level, steady spray of 1-MeV electrons. In the experiments reported here, pulsed irradiation was performed by using the Harry Diamond Laboratories FX-45 in the bremsstrahlung mode, and the steady state irradiation was performed by using a 60Co source. The SXTF fiber has to carry an analog signal during the radiation pulse with negligible distortion due to transient darkening or Cerenkov radiation. Several fibers were tested, and the IVPO fiber was found to be the best because it has very little transient darkening. Cerenkov radiation was effectively removed from all transmitted signals by using narrow optical bandpass filters. GRA

N81-19163# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A PARAMETRIC STUDY OF CERTAIN FORCING FUNCTIONS RELATED TO A HYPERSONIC SLED M.S. Thesis
Victoria A. Tischler Dec. 1980 78 p refs
(AD-A094736; AFIT/GAE/AA/80D-22) Avail: NTIS HC A05/MF A01 CSCL 14/2

The rail roughness profile and the slipper stiffnesses are the important factors in determining the forcing function in the dynamic analysis of high speed rocket sleds. A parametric study involving a variation in the rail roughness profile and the slipper stiffnesses was performed. This study was carried out by interfacing the NASTRAN structural analysis program and a program called SLEDYNE developed for Holloman AFB. Using NASTRAN, a free vibration analysis of the elastic sled body was made in order to obtain the natural frequencies and mode shapes. SLEDYNE simulates the sled ride on the rails and computes a set of inertial forces acting on all the mass points of the sled. The response of the sled to this inertial loading was determined by a NASTRAN static analysis. Two rail roughness profiles were considered, both based on the same set of track measurements, and three values of slipper stiffness were used. Response to the parametric study was measured by the total strain energy of the sled and the displacements of the mass points of the sled. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-19164*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LARGE SPACE SYSTEMS TECHNOLOGY, 1980, VOLUME 1
Frank Kopriver, III, comp. Feb. 1981 445 p refs Presented at the 2nd Ann. Tech. Rev., Hampton, Va., 18-20 Nov. 1980
(NASA-CP-2168; L-14219-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 22B

The technological and developmental efforts in support of the large space systems technology are described. Three major areas of interests are emphasized: (1) technology pertient to large antenna systems; (2) technology related to large space systems; and (3) activities that support both antenna and platform systems. For individual titles, see N81-19165 through N81-19195.

N81-19165*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LSST CONTROL TECHNOLOGY
A. F. Tolivar *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 9-18 (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

The necessary controls technology required for precise

attitude, shape, and pointing control of large space systems (LSS) is defined. The major controls tasks are summarized with emphasis on: (1) the selection of typical antenna and platform configurations, and the definition of models and performance requirements; (2) evaluating the applicability of state-of-the-art control techniques to the control of large antennas and platforms; and (3) identifying the need for and initiating the development of advanced control concepts required for LSS. R.C.T.

N81-19166*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ADVANCED CONTROL TECHNOLOGY FOR LSST ANTENNAS

Y. H. Lin *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 19-30 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The control technology for the realization of large space system technology (LSST) antenna systems was identified and developed. Emphasis was directed at the control of LSST wrap-rib offset-feed antenna. The overall dynamic and control performance of offset-feed antenna was evaluated. Quantitative definitions of control problems were provided and control concepts for future development were identified. R.C.T.

N81-19167*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ADVANCED CONTROL TECHNOLOGY FOR LSST PLATFORM

R. S. Edmunds *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 31-48 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

Basic technology in the design, mechanization, and analysis of control systems for large flexible space structures was examined. The focus of the platform control effort was on pointing control. The reason for this emphasis was because of the unique problems in this area posed by multiple independent experiment packages operating simultaneously on a single platform. Attitude control and stationkeeping were also addressed for future consideration. R.C.T.

N81-19168*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CONTROL TECHNOLOGY DEVELOPMENT

G. Rodriguez *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 49-64 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

Static and dynamic control design approaches were developed for distributed parameter systems. A hardware flexible beam facility was constructed to demonstrate and verify the theoretical control concepts. Efforts were made in the area of model order estimation for control systems with uncertain or time varying parameters. R.C.T.

N81-19169*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTEGRATED ANALYSIS CAPABILITY (IAC) DEVELOPMENT

J. P. Young *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 65-72 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The technical and programmatic aspects of the integrated analysis capability (IAC) are described. The (IAC) is an interdisciplinary analysis system containing a wide range of general purpose analysis programs that are interfaced via a common data base and a unified executive. The system is designed with significant interactive capability as well as the capability to support the entire range of design phases from the definition phase to the verification phase. The system functions as a standalone or interfaced with IPAD. R.C.T.

N81-19170*# Boeing Aerospace Co., Seattle, Wash.

INTEGRATED ANALYSIS CAPABILITY PILOT COMPUTER PROGRAM

R. G. Vos *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 73-86 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

An integrated analysis capability (IAC) computer software package was developed for the design analysis and performance evaluation of large space systems. The IAC aids the user in coupling the required technical disciplines (initially structures, thermal and controls), providing analysis solution paths which reveal critical interactive effects in order to study loads, stability and mission performance. Existing technical software modules, having a wide existing user community, are combined with the interface software to bridge between the different technologies and mathematical modeling techniques. The package is supported by executive, data management and interactive graphics software, with primary development within the superminicomputer environment. R.C.T.

N81-19171*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN ECONOMY OF SCALE SYSTEM'S MENSURATION OF LARGE SPACECRAFT

L. J. DeRyder *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 87-104 refs (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The systems technology and cost particulars of using multipurpose platforms versus several sizes of bus type free flyer spacecraft to accomplish the same space experiment missions. Computer models of these spacecraft bus designs were created to obtain data relative to size, weight, power, performance, and cost. To answer the question of whether or not large scale does produce economy, the dominant cost factors were determined and the programmatic effect on individual experiment costs were evaluated. R.C.T.

N81-19172*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RADIATION EXPOSURE OF SELECTED COMPOSITES AND THIN FILMS

Wayne S. Slemp and Beatrice Santos *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 105-118 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The effect of electron radiation on selected candidate composite materials was investigated. Radiation damage mechanisms were identified and the coefficient of thermal expansion were measured for each type composite material. It was concluded that the threshold for major physical and mechanical property changes in the polysulfone films and in the polysulfone and epoxy composites is in excess of 1 x 10 to the 9th power rads of electrons. Based upon these data, the 5208 and 934 epoxies and the P1700 polysulfone composites would be acceptable for 5 to 10 year geosynchronous Earth environment missions receiving < 1 x 10 to the 9th power rads of electron radiation. R.C.T.

N81-19173*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THERMAL EXPANSION OF COMPOSITES: METHODS AND RESULTS

David E. Bowles and Darrel R. Tenney *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 119-128 refs (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The factors controlling the dimensional stability of various components of large space structures were investigated. Cyclic, thermal and mechanical loading were identified as the primary controlling factors of the dimensional stability of cables. For organic matrix composites, such as graphite-epoxy, it was found that these factors include moisture desorption in the space environment, thermal expansion as the structure moves from the sunlight to shadow in its orbit, mechanical loading, and microyielding of the material caused by microcracking of the matrix material. The major focus was placed on the thermal expansion of composites and in particular the development and testing of a method for its measurement. R.C.T.

N81-19174*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE PLATFORM REFERENCE MISSION STUDIES OVERVIEW

James K. Harrison *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 129-132 (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

The design requirements for three major space platform systems are identified. The three were the Science and Applications Space Platform (SASP), the Geostationary Platform (GSP), and the Satellite Power System (SPS). Because the SASP and GSP were assumed to require no advanced technology for their development an advanced version of each was selected on which to base the design requirements. The SPS represented the opposite development state hence a nearer term test article was selected on which to base the requirements. The development period for these missions is estimated. M.G.

N81-19175*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

ADVANCED SCIENCE AND APPLICATIONS SPACE PLATFORM

Jack White and Fritz Runge *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 133-148 (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

Requirements for and descriptions of the mission equipment, subsystems, configuration, utilities, and interfaces for an Advanced Science and Applications Space Platform (ASASP) are developed using large space structure technology. Structural requirements and attitude control system concepts are emphasized. To support the development of ASASP requirements, a mission was described that would satisfy the requirements of a representative set of payloads requiring large separation distances selected from the Science and Applications Space Platform data base. Platform subsystems are defined which support the payload requirements and a physical platform concept is developed. Structural system requirements which include utilities accommodation, interface requirements, and platform strength and stiffness requirements are developed. An attitude control system concept is also described. The resultant ASASP is analyzed and technological developments deemed necessary in the area of large space systems are recommended. M.G.

N81-19176*# General Dynamics/Convair, San Diego, Calif.

STRUCTURAL REQUIREMENTS AND TECHNOLOGY NEEDS OF GEOSTATIONARY PLATFORMS

G. R. Stone *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 149-166 refs (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

To identify structural requirements and technology needs of the geostationary platforms, two design alternatives are analyzed with respect to utilities accommodation, interface, and strength and stiffness requirements. Alternative 1 is comprised of 6,800 kg (15,000 lb) platform modules, each delivered to low earth orbit (LEO) with an attached orbit transfer vehicle (OTV) in a single Shuttle flight, deployed, and transferred to a geostationary constellation of platforms. Alternative 2 is made up of 16,800 kg (37,000 lb) platform modules, each delivered to LEO, deployed, mated to a 2 stage OTV (delivered to LEO in two additional Shuttle flights) and transferred to GEO for docking with other modules to form a single large platform. The top candidates for deployable structure elements are the expandable truss beam and the Astromast. The beam, fabricated of graphite/epoxy with a designed coefficient of thermal expansion of zero, provides good packaging density and high strength and stiffness per unit weight. The Astromast provides the best packaging density, but lacks the strength and stiffness required for the platform payloads. A graphite/epoxy mast with the Astromast packaging density is an advancement in technology needed for optimizing the geostationary platform designs. M.G.

N81-19177*# Rockwell International Corp., Seal Beach, Calif. Satellite Systems Div.

SUMMARY OF LSST SYSTEMS ANALYSIS AND INTEGRATION TASK FOR SPS FLIGHT TEST ARTICLES

H. S. Greenberg *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 167-182 refs (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

The structural and equipment requirements for two solar power satellite (SPS) test articles are defined. The first SPS concept uses a hexagonal frame structure to stabilize the array of primary tension cables configured to support a Mills Cross antenna containing 17,925 subarrays composed of dipole radiating elements and solid state power amplifier modules. The second test article consists of a microwave antenna and its power source, a 20 by 200 m array of solar cell blankets, both of which are supported by the solar blanket array support structure. The test article structure, a ladder, is comprised of two longitudinal beams (215 m long) spaced 10 m apart and interconnected by six lateral beams. The system control module structure and bridge fitting provide bending and torsional stiffness, and supplement the in plane Vierendeel structure behavior. Mission descriptions, construction, and structure interfaces are addressed. M.G.

N81-19178*# Vought Corp., Dallas, Tex.

ERECTABLE CONCEPTS FOR LARGE SPACE SYSTEM TECHNOLOGY

W. E. Agan *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 183-198 ref (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

Design features of components for space erectable/deployable concepts are described along with the neutral buoyancy testing with the shuttle remote manipulator system. The basic structural configuration is a double folding cubic module. It is 3 meters by 3 meters in crosssection by 6 meters long. The first folding operation results in a 3 meter by 6 meter planar configuration. The second folding operation results in a 9 meter linear configuration. Folding (deployment) is achieved by single and double pivoting joints and telescoping diagonal members. Deployment and retraction is accomplished by an external force. Two joining devices, the module to module coupler and the automatic coupler, were designed and fabricated for test. The module to module coupler features angular and axial locking compliances of 10 deg and 2.5 mm, respectively. It also has a linear zero free play stiffness characteristic. M.G.

N81-19179*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE ASSEMBLY METHODOLOGY

J. W. Stokes and H. H. Watters *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 199-216 (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

Large space structure assembly analysis techniques are defined and simulation activities are described. The simulations included are: an extravehicular activity assembly simulation; a fabricated beam assembly series using a beam generating machine end caps, and cross beam brackets; deployment of a deployable truss, using the neutral buoyancy remote manipulator system with crewman assistance; and a series aboard the KC-135 zero g aircraft. M.G.

N81-19180*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CONSTRUCTION ASSEMBLY AND OVERVIEW

Lyle M. Jenkins *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 217-228 (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

The graphite composite forming and welding technologies for the beam builder concept are discussed. Testing of the prototype truss segment and requirements for orbiter based construction equipment concepts are briefly addressed. M.G.

N81-19181*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

SPACE PLATFORM ADVANCED TECHNOLOGY STUDY

G. C. Burns *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 229-242 (For primary document see N81-19164 10-15)
Avail: NTIS HC A19/MF A01 CSCL 22B

The development of mechanical systems for space platforms which have universal application regardless of what platform configuration is built is discussed. The design requirements and fabrication of the orbiter berthing systems, berthing latch interface, berthing umbilical interface, and adaptive end effector are described. M.G.

N81-19182*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.

A DOCUMENT DESCRIBING SHUTTLE CONSIDERATIONS FOR THE DESIGN OF LARGE SPACE STRUCTURES

John A. Roebuck, Jr. *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 243-258 ref (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

A Shuttle user guide document to aid designers and analysis associated with large space structures projects is described. The format and contents are a compromise designed to satisfy the needs of several levels of users. Special features include checklists and references to source documents as a convenience to very knowledgeable readers. In addition, general, introductory and explanatory text, and art work are included for the reader less familiar with shuttle systems. Also, there are a subject index, glossary, list of acronyms, and many cross references. Throughout the document, there are suggested implications or references to the importance of the included orbiter interfaces material as it pertains to designing and planning large space structures projects. The content of the document is outlined. Shuttle payload accommodations and constraints, connections for orbiter construction fixtures, packaging, and construction space-geometry are addressed. M.G.

N81-19183*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ELECTROSTATIC MEMBRANE ANTENNA CONCEPT STUDIES

J. W. Goslee *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 259-270 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The development of an electrostatic membrane antenna for large space structure applications is discussed. Problems encountered in fabricating 4.88 m (16 foot) diameter thin film membranes are addressed. The development of a test fixture for evaluating the membranes and the comparison of surface measurement systems are also discussed. M.G.

N81-19184*# Systems Science and Software, La Jolla, Calif.

ELECTROSTATIC ANTENNA SPACE ENVIRONMENT INTERACTION STUDY

Ira Katz *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 271-278 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The interactions of the electrostatic antenna with the space environment in both low Earth orbit and geosynchronous orbit are investigated. It is concluded that the electrostatically controlled membrane mirror is a viable concept for space applications. However, great care must be taken to enclose the high voltage electrodes in a Faraday cage structure to separate the high voltage region from the ambient plasma. For this reason, metallized cloth is not acceptable as a membrane material. Conventional spacecraft charging at geosynchronous orbit should not be a problem provided ancillary structures (such as booms) are given nonnegligible conductivity and adequate grounding. Power loss due to plasma electrons entering the high field region is a potentially serious problem. In low earth orbit any opening whatever in the Faraday cage is likely to produce an unacceptable power drain. M.G.

N81-19185*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ENVIRONMENTAL EFFECTS AND LARGE SPACE SYSTEMS

H. B. Garrett *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 279-286 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

When planning large scale operations in space, environmental impact must be considered in addition to radiation, spacecraft charging, contamination, high power and size. Pollution of the atmosphere and space is caused by rocket effluents and by photoelectrons generated by sunlight falling on satellite surfaces even light pollution may result (the SPS may reflect so much light as to be a nuisance to astronomers). Large (100 Km 2) structures also will absorb the high energy particles that impinge on them. Altogether, these effects may drastically alter the Earth's magnetosphere. It is not clear if these alterations will in any way affect the Earth's surface climate. Large structures will also generate large plasma wakes and waves which may cause interference with communications to the vehicle. A high energy, microwave beam from the SPS will cause ionospheric turbulence, affecting UHF and VHF communications. Although none of these effects may ultimately prove critical, they must be considered in the design of large structures. A.R.H.

N81-19186*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

JPL ANTENNA TECHNOLOGY DEVELOPMENT

R. E. Freeland *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 287-294 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

Plans for evaluating, designing, fabricating, transporting and deploying cost effective and STS compatible offset wrap rib antennas up to 300 meters in diameter for mobile communications, Earth resources observation, and for the orbiting VLBI are reviewed. The JPL surface measurement system, intended for large mesh deployable antenna applications will be demonstrated and validated as part of the antenna ground based demonstration program. Results of the offset wrap rib deployable antenna technology development will include: (1) high confidence structural designs for antennas up to 100 meters in diameter; (2) high confidence estimates of functional performance and fabrication cost for a wide range of antenna sizes (up to 300 meters in diameter); (3) risk assessment for fabricating the large size antennas; and (4) 55 meter diameter flight quality hardware that can be cost effectively completed toto accommodate a flight experiment and/or application. A.R.H.

N81-19187*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

OFFSET WRAP RIB ANTENNA CONCEPT DEVELOPMENT

A. A. Woods, Jr. *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 295-324 ref (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

A program to demonstrate large diameter offset reflector technology readiness through the development of ground testable, flight representative full size hardware also aims to provide a basis of data to allow confirmation of cost, performance, and size growth projections for the offset wrap rib antenna design. An overview of the antenna system is presented and the operational deployment sequence examined. The ability to manufacture multiple segment ribs is assured and tooling for rib manufacture was redesigned to reduce cost. The selected mast design permits adequate stiffness and minimum stowed volume. Reflector and mast concerns and the program plan are summarized. A.R.H.

N81-19188*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ANALYTICAL PERFORMANCE PREDICTION FOR LARGE ANTENNAS

M. El-Raheb *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 325-338 ref (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

A linear mathematical modeling of the static and dynamic characteristics of a deployable offset wrap rib antenna was attempted using small motions in an effort to simulate the surface distortion resulting from thermal loading and transient oscillations from control. Both cyclic symmetry and model synthesis were used for parametric analysis. Although the ribs can be modeled as slender beams varying cross sections and equivalent linear material properties, the mesh poses a problem since its equivalent

stress strain relations are highly nonlinear and sensitive to the biaxial prestressed state. Consequently, the macroscopic material properties were measured experimentally in the neighborhood of the design prestress. An equivalent tangent modulus technique was then adopted about this equilibrium state and assumed to be valid within a small range of incremental stresses. A.R.H.

N81-19189*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

JPL SELF-PULSED LASER SURFACE MEASUREMENT SYSTEM DEVELOPMENT

Martin Berdahl *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 339-348 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

Distances from a fixed reference or scan postion to several locations on the surface of an antenna reflector can be measured by using a self pulsed laser ranging system. Processing the information thus obtained is used to define the shape of the surface upon which antenna operational efficiency is direcly dependent. Operation of the system consists of initiating a pulse from the laser emitter which is pointed at the scan mirror. The emitted pulse strikes the scan mirror, is reflected and sent to one of several targets on the surface of the antenna. Upon reflection from the target, the pulse returns to a detector via the scan mirror. The detected pulse is amplified and used to trigger the next emitted pulse. After the first pulse is emitted, received and used to trigger another pulse the process becomes repetitive with a repitition rate uniquely determined by the distance traveled to the target and back. A measure of the repetition rate or frequency thus created provides the means required for determining range since the total distance traveled is inversely proportional to the frequency. A.R.H.

N81-19190*# Boeing Aerospace Co., Kent, Wash.

ANTENNA SYSTEMS REQUIREMENTS DEFINITION STUDY

C. T. Golden *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 349-356 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

A plan to use a 55m wrap rib antenna in a second generation land mobile satellite service application as a specific mission to define a large space structure technology system and its interfaces is described. The system design aims to examine the launch phase of the mission including interface with the space transportation system and the orbital transfer vehicle, and the deployment from the spacecraft of the boom, antennas, and solar panels. Methods for determining the effect of system configuration on the interfaces and of the space environment and operational events on the system and its subsystem interfaces are discussed. A.R.H.

N81-19191*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HOOP/COLUMN ANTENNA TECHNOLOGY DEVELOPMENT SUMMARY

Thomas G. Campbell *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 357-364 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The Langley Research program for development of hoop/column antenna technology was redirected and includes the fabrication and test of models such as the 4 gore segment of a 50 meter antenna and the 15 meter diameter fully deployable antenna. Significant results were obtained in the point design that includes a quad aperture reflector system for multiple beam applications. A.R.H.

N81-19192*# Harris Corp., Melbourne, Fla. Government Systems Group.

DEVELOPMENT OF THE MAYPOLE (HOOP/COLUMN) DEPLOYABLE REFLECTOR CONCEPT FOR LARGE SPACE SYSTEMS APPLICATION

D. C. Montgomery *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 365-406 (For primary document see N81-19164 10-15)

(Contract NAS1-15763)

Avail: NTIS HC A19/MF A01 CSCL 22B

A review of the NASA supplied mission scenarios for the communications, radiometry and radio astronomy missions. Led to specific hoop/column antenna configurations for each mission. The mission configurations were then evaluated to identify specific technology items requiring further development. The compilation of these technology drivers resulted in a specification of an artificial or point design, the design element around which all design and performance estimates for the rest of the program were made. Mechanisms for deployment and stowing are examined including the cable driven mast and the latch pulley roller. Methods for determining the thermal expansion of candidate materials, the development of the cables, cords, and hinged joints, and surface adjustment are considered. A.R.H.

N81-19193*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RADIO FREQUENCY PERFORMANCE PREDICTIONS FOR THE HOOP/COLUMN POINT DESIGN

Thomas G. Campbell *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 407-430 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

Preliminary antenna pattern tests were conducted to determine if catastrophic effects were produced by cables (conducting) in the aperture. This test consisted of an apex feed illuminating a 3 meter solid reflector. A hoop/column configuration was used in positioning the various wires and cables. Radiation patterns were measured at 7 GHz and 10 GHz. No catastrophic effects were observed for this configuration, but additional tests are required to determine the effects for more precision multiple beam applications. In order to better understand the scattering and blockage effects on multiple beam performance, a 35 GHz model was used to model somewhat a single quad aperture configuration. Experimental results using this models are presented in graphs. A.R.H.

N81-19194*# General Electric Co., Philadelphia, Pa. Valley Forge Center.

OFFSET FED UTILIZATION OF FOUR QUADRANTS OF AN AXIALLY SYMMETRICAL ANTENNA STRUCTURE

P. Foldes *In* NASA. Langley Research Center Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 431-438 (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

Theoretical calculations conducted for the use of the hoop column structure were in a quad antenna configuration. The coverage of the US 48 states by a C band Comsat system, which operates in the 3.7 - 4.2 GHz downlink and 5.925 - 6.425 GHz uplink frequency band is considered. This system provides most of its coverage toward major cities (10 or 18 spot beams) and the rest of its coverage on a contiguous basis for the remaining of the country. An alpha = .5 and .3 cell size (approximate component bandwidth) is assumed. Among the practically infinite possible beam topologies one plan for the area coverage and three plans for the spot beam coverage are analyzed. A.R.H.

N81-19195*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SURFACE ACCURACY MEASUREMENT SENSOR FOR DEPLOYABLE REFLECTOR ANTENNAS

R. B. Spiers, Jr. *In its* Large Space Systems Technol., 1980, Vol. 1 Feb. 1981 p 439-448 refs (For primary document see N81-19164 10-15)

Avail: NTIS HC A19/MF A01 CSCL 22B

The breadboard surface accuracy measurement sensor is an optical angle sensor which provides continuous line of sight position measurements of infrared source targets placed strategically about the antenna surface. Measurements of target coordinates define the surface figure relative to a reference frame on the antenna. Sensor operation, tests and test results to date are described. A.R.H.

N81-19196*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE 1980 LARGE SPACE SYSTEMS TECHNOLOGY. VOLUME 2: BASE TECHNOLOGY

Frank Kopriver, III, comp. (Systems Management Associates, Hampton, Va.) Feb. 1981 188 p refs Second Annual Technical Review held in Hampton, Va., 18-20 Nov. 1980
(NASA-CP-2168-Vol-2; L-14219) Avail: NTIS HC A09/MF A01 CSCL 22B

Technology pertinent to large antenna systems, technology related to large space platform systems, and base technology applicable to both antenna and platform systems are discussed. Design studies, structural testing results, and theoretical applications are presented with accompanying validation data. A total systems approach including controls, platforms, and antennas is presented as a cohesive, programmatic plan for large space systems. For individual titles, see N81-19197 through N81-19207.

N81-19197*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

OPTIMUM DAMPER LOCATIONS FOR A FREE-FREE BEAM

G. C. Horner *In its* The 1980 Large Space System Technol., Vol. 2 Feb. 1981 p 5-16 (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

Algorithms to optimally locate and design dampers for large space structures were developed. The requirements for distributed sensing and actuation in control of structural systems were determined. Mathematical programming was used to solve for optimum damping rate and location. Actuator dynamics were considered to solve for optimum actuator mass. E.D.K.

N81-19198*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CONTROL THEORETICS FOR LARGE STRUCTURAL SYSTEMS

In its The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 17-34 (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

The areas of research addressed include modeling identification for both the purposes of analysis and controls, design of structural control systems actuator sensor placement, and distributed sensing and actuation as opposed to co-located sensor and actuators. Also investigated are adaptive/learning processes that could more specifically be referred to as inflight testing procedures where a structure is tested during its deployment or assembly and during its orbital life at specific points where the characteristics of the structure for the purpose of tuning the control system are identified. Another area is redundancy management techniques for structural systems. This is important because of the reliability issue for managing multiple very large numbers of sensors and actuators. E.D.K.

N81-19199*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

BUCKLING AND VIBRATION OF PERIODIC LATTICE STRUCTURES

Melvin S. Anderson *In its* The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 35-44 ref (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

Lattice booms and platforms composed of flexible members or large diameter rings which may be stiffened by cables in order to support membrane-like antennas or reflector surfaces are the main components of some large space structures. The nature of these structures, repetitive geometry with few different members, makes possible relatively simple solutions for buckling and vibration of a certain class of these structures. Each member is represented by a stiffness matrix derived from the exact solution of the beam column equation. This transcendental matrix gives the current member stiffness at any end load or frequency. Using conventional finite element techniques, equilibrium equations can be written involving displacements and rotations of a typical node and its neighbors. The assumptions of a simple trigonometric mode shape is found to satisfy these equations exactly; thus the entire problem is governed by just one 6 x 6 matrix equation involving the amplitude of the displacement and rotation mode shapes. The boundary conditions implied by this solution are simple supported ends for the column type configurations. E.D.K.

N81-19200*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STRUCTURAL SIZING CONSIDERATIONS FOR LARGE SPACE STRUCTURES

Walter L. Heard, Jr., Harold G. Bush, and Joseph E. Walz *In its* The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 45-58 refs (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

A number of missions for the space shuttle were proposed which involve placing large truss platforms on-orbit. These platforms range in size from tens of meters in span for reflector application to several thousand meters for solar power collector application. These proposed sizes and the operational requirements considered are unconventional in comparison to Earthbound structures and little information exists concerning efficient proportions of the structural elements forming the framework of the platforms. Such proportions are of major concern because they have a strong influence on the packaging efficiency and, thus, the transportation effectiveness of the shuttle. The present study is undertaken to: (1) identify efficient ranges of application of deployable and erectable platforms configured for shuttle transport to orbit, and (2) determine sensitivity to key parameters of minimum mass deployable and erectable platform designs. E.D.K.

N81-19201*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DEPLOYMENT TESTS OF A 36-ELEMENT TETRAHEDRAL TRUSS MODULE

R. W. Herr and G. C. Horner *In its* The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 59-69 (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

In the past, models of deployable structures were limited largely to small scale models which could be readily deployed by suspending the model on several soft shock cords. The scale of the deployable truss used in the present investigation precluded the use of this test technique as the gravity forces and moments are of the same order of magnitude as the deployment forces and moments. For these tests, the truss was deployed during free-fall in the LaRC 55' vacuum facility. Appreciably larger trusses could be deployed by lofting the packaged truss upward from the floor of the facility and allowing it to deploy during the upward as well as the downward portion of its trajectory, thus doubling the available test time. It must be realized, of course, that the mechanisms required to loft and decelerate such a large truss would be much more complex than those required for a straight drop. E.D.K.

N81-19202*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

AUTOMATED INSTALLATION OF LARGE PLATFORM UTILITIES

R. M. Vernon *In* NASA. Langley Research Center The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 71-88 refs (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

The capabilities of the assembler in installing nonstructural platform systems were assessed. These systems include electrical power distribution, heat transport, command and data signal transmission, and payload data transmission. The effects of including installation of utilities on the assembly process and on the design, operation, and performance of the assembler were evaluated. In addition, any special requirements on the assembler and/or the platform due to the installation of utilities were identified. The procedure followed was to define a set of candidate utility characteristics and installation requirements, define and design installation concepts, and perform an assessment of impacts on the assembler and its operation. E.D.K.

N81-19203*# Astro Research Corp., Carpinteria, Calif.

FREE-FLYING SOLAR REFLECTOR SPACECRAFT

John M. Hedgepeth *In* NASA. Langley Research Center The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 89-101 refs (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

Results of investigations of requirements and design concepts for large solar-reflecting spacecraft are given. The emphasis is

on the one kilometer diameter self contained spacecraft that can be packaged and launched in the space shuttle. The configuration consists of a compression rim stabilized by stays coming from each end of the central compression hub. The stays are stowed on reels on the ends of the hub. The hub consists of two Astromasts which are deployed after launch. The reflector membrane is a two micron thick Kapton film with a vapor deposited aluminum coating. E.D.K.

N81-19204*# Astro Research Corp., Carpinteria, Calif.
DESIGN CONCEPTS FOR LARGE ANTENNA REFLECTORS
John M. Hedgepeth *In* NASA. Langley Center The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 103-119 refs (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

A type of antenna reflector was studied in which a stiff structure is constructed to hold a membrane like reflector mesh in the correct position. An important basic restriction is that the mesh be controlled only by the structure and that no additional local shaping be employed. Furthermore, attention is confined to structures in which no adjustments would be made on assembly. Primary attention is given to the tetrahedral truss configuration because of its outstanding stiffness and dimensional stability. E.D.K.

N81-19205*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A MODULAR APPROACH TOWARD EXTREMELY LARGE APERTURES
A. A. Woods, Jr. *In* NASA. Langley Research Center The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 121-143 ref (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

Modular antenna construction can provide a significant increase in reflector aperture size over deployable reflectors. The modular approach allows reflective mesh surfaces to be supported by a minimum of structure. The kinematics of the selected deployable design approach were validated by the subscale demonstration model. Further design refinements on the module structural/joints and design optimization on intermodule joints are needed. E.D.K.

N81-19206*# General Dynamics/Convair, San Diego, Calif.
MODULAR REFLECTOR CONCEPT STUDY
D. H. Vaughan *In* NASA. Langley Research Center The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 145-169 (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

The feasibility was studied of constructing large space structures, specifically a 100 meter paraboloidal R.F. reflector, by individually deploying a number of relatively small structural modules, and then joining them to form a single large structure in orbit. The advantage of this approach is that feasibility of a large antenna may be demonstrated by ground and flight tests of several smaller and less costly subelements. Thus, initial development costs are substantially reduced and a high degree of reliability can be obtained without commitment to construction of a very large system. The three candidate structural concepts investigated are: (1) the deployable cell module; (2) the paraboloidal extendable truss antenna adapted to modular assembly; and (3) the modular extendable truss antenna (META). E.D.K.

N81-19207*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ELECTROMAGNETIC ANALYSIS FOR LARGE REFLECTOR ANTENNAS
M. C. Bailey *In its* The 1980 Large Space Systems Technol., Vol. 2 Feb. 1981 p 171-183 (For primary document see N81-19196 10-15)
Avail: NTIS HC A09/MF A01 CSCL 22B

A comparison is made between the measured E and H plane patterns of the 35 GHz offset paraboloidal reflector and the calculated patterns for the same reflector using the 200 points to describe the surface. The accuracy of the computer prediction is quite good considering that the only description of the surface was the coordinates of a finite number of points on the reflector. The results indicate the possibility of acceptable accuracy in the prediction of electromagnetic performance for arbitrarily distorted reflectors using the coordinates of a practical number of measured points. An optimization of the number and distribution of points, and experimental verification for a distorted reflector are planned. E.D.K.

N81-19208*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER SYSTEM FOR GEOSYNCHRONOUS SATELLITE NAVIGATION
David W. Koch Dec. 1980 13 p refs Presented at the IEEE Position Location and Navigation Symp. (PLANS 80), Atlantic City, N.J., 8-11 Dec. 1980 Submitted for publication
(NASA-TM-82063) Avail: NTIS HC A02/MF A01 CSCL 22B

A computer system specifically designed to estimate and predict Geostationary Operational Environmental Satellite (GOES-4) navigation parameters using Earth imagery is described. The estimates are needed for spacecraft maneuvers while prediction provide the capability for near real-time image registration. System software is composed of four functional subsystems: (1) data base management; (2) image processing; (3) navigation; and (4) output. Hardware consists of a host minicomputer, a cathode ray tube terminal, a graphics/video display unit, and associated input/output peripherals. System validity is established through the processing of actual imagery obtained by sensors on board the Synchronous Meteorological Satellite (SMS-2). Results indicate the system is capable of operationally providing both accurate GOES-4 navigation estimates and images with a potential registration accuracy of several picture elements (pixels). M.G.

N81-19209*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF A PRECISE POSITIONING SYSTEM OF THE COMSS ALTIMETRIC SATELLITE/RADAR
F. Nouel and M. Berge Mar. 1981 114 p Transl. into ENGLISH of Etude d'un systeme de Positionnement Precis de Satellite/Radar Altimetrique COMSS - HASP (High Accuracy System Position) (Toulouse), no. 85.55.00, 1980 p 115 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76491) Avail: NTIS HC A06/MF A01 CSCL 22B

A satellite trajectory was reconstructed at an accuracy level of 5-10 centimeters. The reconstruction of the orbit at a level of 1 to 2 meters, and comparison of all results for the two altitudes, 650 and 850 km, are also considered. T.M.

N81-19210# Harry Diamond Labs., Adelphi, Md.
PERFORMANCE OF RAM AIR DRIVEN POWER SUPPLY FOR PROPOSED HIGH ALTITUDE ROCKET IN NAVAL SURFACE WEAPONS CENTER SUPERSONIC WIND TUNNEL
Jonathan E. Fine Nov. 1980 47 p refs Sponsored in part by Navy
(AD-A094719; HDL-TM-80-31) Avail: NTIS HC A04/MF A01 CSCL 21/9

A ram air driven power supply for the Multiple Launch Rocket System (MLRS) air vehicle was tested with a fuze in the Naval Surface Weapons Center Supersonic Wind Tunnel Facility. The power supply operated the fuze over the apex of a probable flight trajectory where the generator's inlet ram air energy input is small. A method has been devised to relate laboratory, wind tunnel, and field test data so that expected voltages in flight or in the wind tunnel can be obtained from laboratory measurements. GRA

N81-19211# Naval Postgraduate School, Monterey, Calif.
TACTICAL MISSILE CONCEPTUAL DESIGN
Danny Ray Redmon Sep. 1980 317 p refs
(AD-A095118) Avail: NTIS HC A14/MF A01 CSCL 16/4

This thesis presents the theory necessary for the conceptual design of a tactical missile. The design process begins with the well known linear aerodynamic theory for initial sizing and later includes nonlinear effects to determine the final design of the missile. Where theory does not apply, empirical methods are presented which are known to give accurate results. An air-to-air

missile is designed for a specific threat as an example which immediately follows the development of the theory for each section. Several small digital computer programs are presented and used for analysis of specific areas of the design. One large program (AEROL) is used for determining the aerodynamic coefficients of the final design. GRA

N81-19212# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.
INVESTIGATION OF PLUME INDUCED SEPARATION ON A FULL-SIZE MISSILE AT SUPERSONIC VELOCITIES
T. A. Martin 20 Jun. 1980 26 p
(AD-A094742; AD-E950082; DRSMI/RD-80-12-TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A large amount of data to determine plume effects have been obtained from various simulation techniques. To provide data for evaluating the adequacy of these simulations, a test utilizing a rocket sled to measure surface pressures on a full-size, live, high thrust rocket at Mach number up to Moo 1.6. Selected portions of the data are presented to show Mach number and thrust level effects. GRA

N81-19213# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MODAL CONTROL OF A SATELLITE IN ORBIT ABOUT L3 M.S. Thesis
William L. Shelton Dec. 1980 84 p refs
(AD-A094812; AFIT/GA/AA/80D-3) Avail: NTIS HC A05/MF A01 CSCL 12/1

A modal control scheme was developed for linear systems that are time periodic. The scheme was then applied to a satellite in orbit about the Earth-moon Lagrange point, L3. A theoretical control gain prediction was also devised and then verified by numerical results. The feasibility of the control scheme was then verified by computer simulations by controlling the actual non-linear motions of the satellite with the linearly derived controller. The satellite control costs were found to be 30 percent less than the control costs of a satellite in Earth-synchronous orbit. GRA

N81-19214# Royal Norwegian Council for Scientific and Industrial Research, Oslo.
ANDOEYA ROCKET RANGE. NORWAY
1979 42 p
Avail: NTIS HC A03/MF A01

The Andoeya sounding rocket range is described, including the geographical location and weather conditions, the scientific ground equipment, balloon launching facilities and the rocket launch characteristics. The renting of the range, the shipping and customs regulations, and space research in Norway are commented on. Author (ESA)

N81-19215# National Environmental Satellite Service, Washington, D. C. Office of Systems Integration.
EARTH LOCATING IMAGE DATA OF SPIN STABILIZED GEOSYNCHRONOUS SATELLITES
Larry N. Hambrick and Dennis R. Phillips Aug. 1980 112 p refs
(PB81-120321; NOAA-TM-NESS-111; NOAA-80101002) Avail: NTIS HC A06/MF A01 CSCL 22C

Aspects of the GOES system relevant to Earth location are reviewed. The essential features of an Earth location capability that satisfies the needs of users of the data are specified. A mathematical formulation of the geometry and orbit/attitude determinations including the actual algorithms, is presented. The implementation of these methods on VIRGS is described. Finally, the rationale for a centralized once for all users earth location service and an error budget with some actual results are presented. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-19216*# Rocketdyne, Canoga Park, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY. PHASE A: CONTINUATION (STUDY RESULTS)
28 Feb. 1981 101 p refs
(Contract NAS8-32996)
(NASA-CR-161668; RI/RD81-120) Avail: NTIS HC A06/MF A01 CSCL 22B

Studies included: selection of boost pump designs for low NPSH operation and generation of associated programmatic data; evaluation of OTV engine operation at intermediate thrust levels and impact on programmatics; and assessments of OTV engine operation at idle-mode thrusts under conditions experienced during aerobraking maneuvers of the ABOTV. As a result of the studies, it was recommended that the original OTV boost pump designs be used without change for low NPSH operation. Intermediate thrust operation is feasible for both the expander cycle and staged combustion cycles. T.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-19217*# Rohr Corp., Chula Vista, Calif.
FABRICATION OF TITANIUM MULTI-WALL THERMAL PROTECTION SYSTEM (TPS) TEST PANEL ARRAYS Interim Report
W. Blair, J. E. Meaney, and H. A. Rosenthal Dec. 1980 38 p refs
(Contract NAS1-15646)
(NASA-CR-159383) Avail: NTIS HC A03/MF A01 CSCL 22B

Several arrays were designed and tested. Tests included vibrational and acoustical tests, radiant heating tests, and thermal conductivity tests. A feasible manufacturing technique was established for producing the protection system panels. T.M.

N81-19218*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY VIBRATION, ACOUSTIC, AND SHOCK DESIGN AND TEST CRITERIA FOR COMPONENTS ON THE LIGHTWEIGHT EXTERNAL TANK (LWT)
Feb. 1981 322 p refs
(NASA-RP-1074; M-343) Avail: NTIS HC A14/MF A01 CSCL 22B

The Space Shuttle LWT is divided into zones and subzones. Zones are designated primarily to assist in determining the applicable specifications. A subzone (general Specification) is available for use when the location of the component is known but component design and weight are not well defined. When the location, weight, and mounting configuration of the component are known, specifications for appropriate subzone weight ranges are available. Along with the specifications are vibration, acoustic, shock, transportation, handling, and acceptance test requirements

and procedures. A method of selecting applicable vibration, acoustic, and shock specifications is presented. A.R.H.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-19219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF A MAGNETIC MULTIPOLE LINE-CUSP ARGON ION THRUSTER

James S. Sovey 1981 12 p refs Proposed for presentation at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981; cosponsored by the AIAA, the Japan Soc. for Aeronautical and Space Sciences, and Deutsche Gesselschaft Fuer Luft- und Raumfahrt

(NASA-TM-81703; E-729) Avail: NTIS HC A02/MF A01 CSCL 21C

A 17 cm diameter line cusp ion thruster was evaluated with inert gases which are candidate propellants for on orbit and orbit transfer propulsion functions for Large Space Systems. A semiempirical relationship was generated to predict thruster beam current in terms of plasma parameters which would allow initial thruster optimization without ion extraction and the associated large vacuum facilities. The sensitivity of performance to changes in discharge electrode configurations and magnetic circuit was evaluated and is presented. After final optimization a propellant utilization efficiency of 0.9 at a discharge chamber power expenditure of about 260 w per beam ampere was obtained. These performance parameters are the highest yet achieved with argon propellant. Author

N81-19220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE CAPABILITIES OF THE 8-CM MERCURY ION THRUSTER

M. A. Mantenieks 1981 13 p refs Proposed for Presentation at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981; cosponsored by the AIAA, the Japan Soc. for Aeronautical and Space Sciences, and Deutsche Gesselschaft Fuer Luft- und Raumfahrt

(NASA-TM-81720; E-755) Avail: NTIS HC A02/MF A01 CSCL 21C

A preliminary characterization of the performance capabilities of the 8-cm thruster in order to initiate an evaluation of its application to LSS propulsion requirements is presented. With minor thruster modifications, the thrust was increased by about a factor of four while the discharge voltage was reduced from 39 to 22 volts. The thruster was operated over a range of specific impulse of 1950 to 3040 seconds and a maximum total efficiency of about 54 percent was attained. Preliminary analysis of component lifetimes, as determined by temperature and spectroscopic line intensity measurements, indicated acceptable thruster lifetimes are anticipated at the high power level operation. T.M.

N81-19221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ION BEAM DEPOSITED PROTECTIVE FILMS

Michael J. Mirtich 1981 16 p refs Proposed for presentation at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981; sponsored by the AIAA, the Japan Society for Aeronautical and Space Sciences, and Deutsche Gesselschaft Fuer Luft- und Raumfahrt

(NASA-TM-81722; E-759) Avail: NTIS HC A02/MF A01 CSCL 21C

Single or dual ion beam sources were used to deposit thin films for different applications. Metal and metal oxide films were evaluated as protective coatings for the materials. Film adherence was measured and the most promising films were then tested under environments similar to operating conditions. It was shown that some materials do protect die material (H-13 steel) and do reduce thermal fatigue. Diamondlike films have many useful applications. A series of experiments were conducted to define and optimize new approaches to the manufacture of such films. A dual beam system using argon and methane gases was developed to generate these films. T.M.

N81-19222*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SERT II 1980 EXTENDED FLIGHT THRUSTER EXPERIMENTS

W. R. Kerslake and L. R. Ignaczak 1981 27 p refs Presented at 15th Intern. Elec. Propulsion Conf., Las Vegas, Nevada, 21-23 Apr. 1981; sponsored by Japan Society for Aeronautical and Space Sciences and PGLR

(NASA-TM-81685; E-695) Avail: NTIS HC A03/MF A01 CSCL 21C

The flight results obtained from mid 1979 through December 1980 are presented. Near continuous solar power in 1979 and 1980 has enabled long periods of thruster endurance testing. Three of four propellant tanks were exhausted with no significant change in thruster system operation before being empty. A new plasma mode thrust was characterized and direct thrust measurements obtained. Other tests, including beam neutralization by various neutralizer sources, give insight to electron conduction across plasmas in space and provide a basis to model neutralization of thruster arrays. E.D.K.

N81-19223# TRW Defense and Space Systems Group, Redondo Beach, Calif.

FLTSATCOM FLIGHT 2 RCS ANOMALY INVESTIGATION GROUND VERIFICATION TEST Final Report

G. W. Joseph 30 Jan. 1981 144 p

(Contract F04701-79-C-0174)

(AD-A094764; TRW-36244-350-004-01; SD-TR-80-58) Avail: NTIS HC A07/MF A01 CSCL 21/8

Thruster Hot-fire Ground Verification Tests have been performed in an attempt to understand the thruster anomalies that were experienced on the FLTSATCOM Flight 2 spacecraft (IRON 6392). While the test objectives of determining the effect of gas bubble ingestion, cold starts with isolation valves closed, effect of seat leakage on first pulses, and susceptibility to 'choking' were accomplished, the exact cause for the anomaly was not established. No deleterious effects from cold starts with isolation valves closed were observed. GRA

N81-19224# TRW Defense and Space Systems Group, Redondo Beach, Calif.

PULSED INDUCTIVE THRUSTER DEVELOPMENT (ADVANCED ELECTRIC PROPULSION TECHNOLOGY - HIGH THRUST) Final Technical Report, Oct. 1979 - Nov. 1980

C. L. Dailey and R. H. Lovberg Jan. 1981 110 p refs

(Contract F04611-79-C-0058; AF Proj. 5730)

(AD-A094884; AFRPL-TR-80-67) Avail: NTIS HC A06/MF A01 CSCL 20/9

This report describes the results of an experimental investigation of the operation and efficiency of a large impulsive plasma thruster. The thruster uses a one-meter diameter flat spiral coil through which current is pulsed by discharging a 4000 Joule capacitor bank using a spark gap switch. The plasma is driven through inductive coupling rather than with electrodes so as to avoid erosion and energy loss mechanisms that might be undesirable for spacecraft uses. The object of the work was to

compare thruster efficiency with pulsed gas injection to the 'static fill' efficiency of a similar one-meter, diameter, coil thruster tested earlier. Using only the first half-cycle impulse, the 'static fill' efficiency had been 38% at 1730 seconds Isp. Using the impulse of three half-cycles for the present pulsed injection test (0.190, 0.033 and 0.011 Newton-seconds) the measured thrust efficiency was 45% at 1570 seconds Isp. GRA

N81-19225# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THREE BURN INERTIAL UPPER STAGE OPTIMAL ORBIT TRANSFER M.S. Thesis
Mark N. Brown Dec. 1980 60 p refs
(AD-A094811; AFIT/GA/AA/80D-1) Avail: NTIS HC A04/MF A01 CSCL 22/3

The Inertial Upper Stage (IUS) being developed for use aboard the Space Shuttle is composed of three solid fuel stages plus a satellite payload. One mission of the IUS system is to launch from a shuttle parking orbit and place the satellite in geosynchronous orbit in minimum time. Actual Space Shuttle parking orbit data and IUS characteristics were used in this study to examine the sequential timing and orientation in inertial space of each stage as it is fired while the spacecraft moves along a transfer orbit to geosynchronous orbit. In addition, the sensitivity of the total transfer time and the final orbital state was found as a result of not meeting one or all of the time and orientation parameters. This problem is unique in that it considers an optimal orbit transfer problem involving solid fuel stages of fixed thrust and burn time. Previous work with liquid fuel engines examined orbital transfers with the intent of minimizing the amount of propellant or required velocity change needed to accomplish the transfer. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-19226 Iowa State Univ. of Science and Technology, Ames.
GRAIN SIZE DEPENDENCE OF MICROCRACK INITIATION IN BRITTLE MATERIALS Ph.D. Thesis
Eldon Darrel Case 1980 143 p
Avail: Univ. Microfilms Order No. 8103434

The Young's modulus of polycrystalline Al2O3, Gd2O3, and MgTi2O5 was measured as a function of temperature. Hysteresis between heating and cooling data was observed for all of the Gd2O3 and MgTi2O5 specimens and for the Al2O3 specimens having the largest grain size. The observed hysteresis is attributed to the opening of microcracks during cooling and to crack closure during heating. A theoretical model was developed to describe T sub MB the temperature at which microcracking begins, as a function of grain size. The Cleveland-Bradt equation for critical grain size was also extended so that it could be compared to the model. For each of the three materials studied, the slope of T sub MB verus grain size agreed relatively well with that predicted by the model, to within a multiplicative constant of about 1.7162. The extended Cleveland-Bradt equation fit the data less well. A graphical method of predicting critical grain size was also demonstrated. Dissert. Abstr.

N81-19227 Washington Univ., St. Louis, Mo.
PREDICTION AND MEASUREMENT OF THE DURABILITY AND RELIABILITY OF ELASTOMERIC BIOMATERIALS Ph.D. Thesis
Kishor Purushottam Gadkaree 1980 144 p
Avail: Univ. Microfilms Order No. 8103708

Fatigue failure is assumed to initiate from an equivalent sharp edge crack. The edge crack size is obtained from the relationships between breaking strength and edge crack size, which is experimentally determined. Thus, knowing breaking strength distribution, crack size distribution is obtained. Tearing energy correlates crack growth data very well. The crack growth experiments were done at 0.01, 0.1 and 1 cps. From these experiments crack growth law constants were obtained. Utilizing these constants, and crack size distribution, distribution of crack sizes after n fatigue cycles is found. From this the lifetime distribution of specimens is found. Experimental results showed very good agreement with the theoretically predicted distribution function. Experiments were carried out at 1556 psi, 900 psi, 750 psi and 606 psi. It was found that at 606 psi the specimen was not stretched above fatigue limit and so did not fail. Extension of this method to rigid polymers and metals is also explained. Dissert. Abstr.

N81-19228# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
RAPID AND CONTINUOUS AEROBIC FERMETATION OF ORGANIC SOLIDS
Sentaro Takeko 1981 22 p Transl. into ENGLISH of Japanese Patent Kokai No. 7872886 (Appl. No. 76148535, 10 Dec. 1976) 22 p
(NRC/CNR-TT-1982; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

Emphasis is placed on attuning the fermentation process to the ecology of the microorganisms involved in activating solid organic wastes. The material that is to be fermented is placed in a vertical, cylindrical tank and is constantly agitated by rotating wings in order to keep it from clumping together. While the agitation is taking place, air and water are supplied in amounts that will provide the optimal growth conditions for the various populations of microorganisms inhabiting each layer of the fermenting material that settled out as sediment. The oxygen, temperature, and moisture conditions can be adjusted for each layer to regulate the extent at which the material is fermented, thus controlling the quality of the final product. A.R.H.

24 COMPOSITE MATERIALS

Includes laminates.

N81-19229*# Fiber Materials, Inc., Biddeford, Maine.
FABRICATION OF ALUMINUM OXIDE FIBER REINFORCED ALUMINUM MATRIX COMPOSITES Final Report
J. E. Hack and G. C. Strempek Nov. 1980 89 p refs
(Contract NAS3-21013)
(NASA-CR-165184) Avail: Issuing Activity CSCL 11D

The mechanical fabrication of polycristalline alumina fiber reinforced aluminum composites was accomplished. Wire preform material was prepared by liquid metal infiltration of alumina fiber bundles. The wires were subsequently fabricated into bulk composite material by hot drawing. Extensive mechanical, thermal and chemical testing was conducted on preform bulk material to develop a process and materials data base. In addition, a preliminary investigation of mechanical forming of bulk alumina fiber reinforced aluminum composite material was conducted. Author

N81-19230*# National Aeronautics and Space Administration. Pasadena Office, Calif.
FIBERGLASS/EPOXY COMPOSITE AUTOMOTIVE DOOR STRUCTURE INCLUDING A GLASS-REINFORCED INTRUSION STRIP Patent Application
Jerome L. Bauer, Jr., Inventor (to NASA) (JPL) Filed 19 Feb. 1981 20 p
(NASA-Case-NPO-15057-1; US-Patent-Appl-SN-235867) Avail: NTIS HC A02/MF A01 CSCL 11D

A lightweight, composite outer door panel for a vehicle and a method for forming it are presented. The door is characterized by a molded outer panel having an integral comolded intrusion strip extended along one surface thereof, said outer panel being formed of a sheet molding compound consisting essentially of chopped glass fibers randomly dispersed in a polyester resin and said intrusion strip being formed of a material consisting essentially of continuous glass fibers, and a pair of mutually spaced hinge brackets bonded to the intrusion strip near one end thereof and a latch bracket bonded to the strip near the other end thereof, said brackets being imployed for imparting fixity to the opposite ends of said intrusion strip. NASA

N81-19231*# Grumman Aerospace Corp., Bethpage, N.Y.
SPAR 6 TECHNICAL REPORT FOR EXPERIMENT 76-22:

DIRECTIONAL SOLIDIFICATION OF MAGNETIC COMPOSITES

Ron G. Pirich and David J. Larson, Jr. Jul. 1980 62 p refs
(Contract NAS8-32219)
(NASA-CR-161671; RE-802) Avail: NTIS HC A04/MF A01 CSCL 11D

Samples of eutectic Bi/MnBi were directionally solidified during a low-g interval aboard the SPAR 6 flight and in a l-g environment under identical furnace velocity and thermal conditions. The Bi/MnBi eutectic is characterized by a regular rod eutectic whose morphology may be sensitive to thermo-solutal convection and by its components, MnBi, which is ferromagnetic. Morphological analyses on samples show statistically smaller interrod spacings and rod diameters with respect to samples grown under identical solidification furnace conditions in l-g. An adjustment between the interrod spacing, growth velocity, and total undercooling at the solidification interface is proposed. Morphological analyses on samples grown in l-g indicate little difference between results for different growth orientations with respect to the gravity vector. The magnetic properties are significantly affected, however, by the presence of a nonequilibrium magnetic phase and the nonequilibrium phase transforms to the equilibrium ferromagnetic phase during isothermal heat treatment. J.M.S.

N81-19232*# Lockheed-California Co., Burbank.

ADVANCED COMPOSITE AILERON FOR L-1011 TRANSPORT AIRCRAFT, TASK 1 Final Report, 19 Sep. 1977 - 24 Mar. 1978

C. F. Griffin, L. D. Fogg, R. L. Stone, and E. G. Dunning Jul. 1978 57 p refs
(Contract NAS1-15069)
(NASA-CR-145370; LR-28568) Avail: NTIS HC A04/MF A01 CSCL 11F

Structural design and maintainability criteria were established and used as a guideline for evaluating a variety of configurations and materials for each of the major subcomponents. From this array of subcomponent designs, several aileron assemblies were formulated and analyzed. The selected design is a multirib configuration with sheet skin covers mechanically fastened to channel section ribs and spars. Qualitative analysis of currently available composite material systems led to the selection of three candiate materials on which comparative structural tests were conducted to measure the effects of environment and impact damage on mechanical property retention. In addition, each system was evaluated for producibility characteristics. From these tests, Thornel 300/5208 unidirectional tape was selected for the front spar and covers, and Thornel 300 fabric/5208 was chosen for the ribs. A.R.H.

N81-19233*# Fiber Materials, Inc., Biddeford, Maine.

FABRICATION DEVELOPMENT OF ALUMINA/ALUMINUM COMPOSITES Final Report

G. C. Strempek and D. E. Kizer Nov. 1980 41 p refs
(Contract NAS3-21844)
(NASA-CR-165195) Avail: Issuing Activity CSCL 11D

The mechanical fabrication of polycrystalline alumina fiber reinforced A201 aluminum alloy composite heat and angle shapes is described. Wire preform material was prepared by liquid metal infiltration of alumina fiber bundles. The wire was made into test samples by hot pressing, hot isostatic pressing, and pultrusion. Samples were examined for metallographic and mechanic quality and hot pressing was selected for fabricating hat and angle shapes. A series of processing interations was performed and Al203/A201 hat and angle sections were produced for testing. J.M.S.

N81-19234# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

NATURAL EXPOSURE OF SELECTED GRAPHITE/EPOXY COMPOSITE MATERIAL SYSTEMS Final Report

R. E. Trabocco 31 Jul. 1980 76 p refs
(AD-A094679; NADC-80021-60) Avail: NTIS HC A05/MF A01 CSCL 11/4

A study was made on selected graphite/epoxy composite materials exposed at different geographical locations. The Panama exposure site was more detrimental to reduced static strength than the Warminster, PA site. Coating was found to negate irreversible ultraviolet plus moisture degradation. Reversible elevated temperature moisture degradation was approximately 25% for matrix dominated properties. The T300/5208 system offered the best resistance to degradation from natural exposure. The use of a 6 ply 0 deg. + or - 45 deg panel loaded in sustained flexure was found to enhance scatter. GRA

N81-19235# Naval Research Lab., Washington, D. C. Material Science and Technology Div.

PRELIMINARY CHARACTERIZATION OF ION-PLATED ALUMINUM/GRAPHITE COMPOSITES

R. J. Weimer, A. Pattnaik, and C. Kim 12 Feb. 1981 11 p refs
(RR0220441)
(AD-A094894; NRL-MR-4420) Avail: NTIS HC A02/MF A01 CSCL 11/4

Ion-plated aluminum/graphite (Al/Gr) composite material has been characterized in terms of microstructure, tensile properties, and fractography. Longitudinal and transverse tensile strengths were found to be superior to those of Al/Gr composites fabricated by liquid metal infiltration. More importantly, the Al/Gr precursor tape was thin and flexible enough to allow cross-plying and selective reinforcement in complex shapes. GRA

N81-19236# Air Force Medical Center, Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.

TI-59 MAGNETIC CARD CALCULATOR SOLUTIONS TO COMPOSITE MATERIALS FORMULAS, REVISION Final Report, Jan. - Dec. 1980

Stephen W. Tsai and Aoki Rodolfo Jan. 1981 75 p
(AF Proj. 2419)
(AD-A095123; AFML-TR-79-4040-REV) Avail: NTIS HC A04/MF A01 CSCL 11/4

This volume contains the description and instructions of magnetic cards for TI-59 programmable calculators. These tapes contain the key calculations of the stiffness and strength of unidirectional and laminated composites. Both in-plane and flexural loadings can be applied. The initial stress and strain due to curing moisture adsorption are also included in the strength calculation. With the aid of the magnetic cards, instant calculations can be made for practical use. The use of cards is also an effective teaching tool. The formulas used in the cards and equation numbers have been derived in a book entitled, Introduction to Composite Materials, co-authored by S. W. Tsai and H. T. Hahn, published by Technomic Publishing Company, Westport, CT, July 1980. This TR a revised edition of the technical report bearing the same number published in April 1979. GRA

N81-19237# AiResearch Mfg. Co., Phoenix, Ariz.

MANUFACTURING TECHNIQUES FOR PRODUCING HIGH QUALITY FLUIDIC LAMINATES AT LOW COST Final Report, Jun. 1978 - Aug. 1980

James S. Roundy 2 Sep. 1980 65 p
(Contract N00019-78-C-0365)
(AD-A094695; Rept-41-2697A) Avail: NTIS HC A04/MF A01 CSCL 11/9

This report presents the results of a program conducted by AiResearch for the Naval Air Systems Command and monitored by Harry Diamond Laboratories. The precision stamping and fine blanking manufacturing processes were investigated as a means of producing high quality, low cost fluidic laminates. GRA

N81-19238# Stanford Univ., Calif. Div. of Applied Mechanics.

NONDISPERSIVE WAVE PROPAGATION IN A LAYERED COMPOSITE Interim Report

G. Beaupre and G. Herrmann Oct. 1980 27 p refs
(Contract N00014-76-C-0054; NR Proj. 064-525)
(AD-A094855; SUDAM-80-6) Avail: NTIS HC A03/MF A01 CSCL 11/4

It is found that it is possible to propagate a horizontally polarized (SH) wave without dispersion through an elastic, periodically layered composite. The nondispersive property of the wave is due to the fact that at each interface the angle of incidence is such that the wave is totally transmitted without reflection. In optics, such an angle is referred to as the Brewster angle. It is determined that this particular case is contained as

a special solution of the general dispersion equation for SH waves, which has not been noticed before. GRA

N81-19239# Stanford Univ., Calif. Div. of Applied Mechanics.
AN EFFECTIVE DISPERSION THEORY FOR HORIZONTALLY-POLARIZED WAVES IN LAYERED COMPOSITES Interim Report
T. J. Delph and G. Herrmann Jan. 1981 24 p refs
(Contract N00014-76-C-0054; NR Proj. 064-525)
(AD-A094867; SUDAM-81-1) Avail: NTIS HC A02/MF A01 CSCL 11/4

An extension of a previously developed approximate theory, the effective dispersion theory, for wave propagation in a periodically-layered elastic body is given. While the previous theory was valid only for wave propagation normal to the layering, the present theory removes this restriction in the case of antiplane strain (SH wave) motion. GRA

N81-19240# Stanford Univ., Calif. Div. of Applied Mechanics.
A ONE-DIMENSIONAL EFFECTIVE DISPERSION THEORY FOR LAYERED COMPOSITES Interim Report
T. J. Delph and G. Herrmann Nov. 1980 34 p refs
(Contract N00014-76-C-0054; NR Proj. 064-525)
(AD-A094868; SUDAM-80-7) Avail: NTIS HC A03/MF A01 CSCL 11/4

A new approximate theory for wave propagation in a periodically layered elastic body is proposed. The theory is based on microstructural theories of elasticity and makes use of a collocation technique in conjunction with the exact solution for wave propagation in an unbounded elastic body. The results are in excellent agreement with the exact solution. The new theory is considered to hold considerable promise for formulating approximate solutions to boundary-initial value problems for composite bodies. GRA

N81-19241# Wyoming Univ., Laramie.
THREE-DIMENSIONAL ELASTOPLASTIC FINITE ELEMENT ANALYSIS OF LAMINATED COMPOSITES Ph.D. Thesis Interim Report
Mohamed M. Monib, Donald F. Adams, and David E. Walrath Nov. 1980 124 p refs
(Contract DAAG29-79-C-0189)
(AD-A095147; UWME-DR-001-102-1; ARO-16370.4-MS)
Avail: NTIS HC A06/MF A01 CSCL 11/4

A three-dimensional elastoplastic analysis of generally orthotropic composite laminates is developed, together with a finite element computer code NCLAP (nonlinear Composite Laminate Analysis Program) for its implementation. The analysis is capable of handling any laminated composite subjected to triaxial mechanical and/or hygrothermal loading conditions. The laminates can consist of any number of orthotropic material piles, of any orientations. Elastoplastic material behavior is included by means of the tangent modulus method. The onset of plastic deformation is determined by a failure surface in three-dimensional space, and is likewise dependent on temperature and moisture. The three-dimensional finite element analysis is based on a displacement formulation employing linear isoparametric elements. Large aspect ratios, typical of laminae finite element representations, are handled by the use of reduced integration techniques. Material properties are input to NCLAP as coefficients of second order polynomials describing the elastoplastic response, and the dependence on temperature and moisture content. Incremental mechanical loadings can be applied as nodal forces and/or prescribed displacements. Hygrothermal loadings are applied as constant overall changes, or as spatial distributions, of temperature and moisture content. Computer Program NCLAP has been developed in modular form, which will permit it to be easily modified to accommodate future extensions of the analysis.GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 *Thermodynamics and Statistical Physics*.

N81-19242* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCESS FOR PREPARATION OF LARGE-PARTICLE-SIZE MONODISPERSE LATEXES Patent
John W. Vanderhoff (Lehigh Univ.), Fortunato J. Micale (Lehigh Univ.), Mohamed S. El-Aasser (Lehigh Univ.), and Dale M. Kornfeld, inventors (to NASA) Issued 27 Jan. 1981 4 p Filed 29 Dec. 1978 Supersedes N79-14171 (17 - 05, p 0571)
(NASA-Case-MFS-25000-1; US-Patent-4,247,434;
US-Patent-Appl-SN-974474; US-Patent-Class-260-29.6RB;
US-Patent-Class-526-88; US-Patent-Class-526-201) Avail: US Patent and Trademark Office CSCL 07A

Monodisperse latexes having a particle size in the range of 2 to 40 microns are prepared by seeded emulsion polymerization in microgravity. A reaction mixture containing smaller monodisperse latex seed particles, predetermined amounts of monomer, emulsifier, initiator, inhibitor and water is placed in a microgravity environment, and polymerization is initiated by heating. The reaction is allowed to continue until the seed particles grow to a predetermined size, and the resulting enlarged particles are then recovered. A plurality of particle-growing steps can be used to reach larger sizes within the stated range, with enlarge particles from the previous steps being used as seed particles for the succeeding steps. Microgravity enables preparation of particles in the stated size range by avoiding gravity related problems of creaming and settling, and flocculation induced by mechanical shear that have precluded their preparation in a normal gravity environment.

Official Gazette of the U.S. Patent and Trademark Office

N81-19243 Washington State Univ., Pullman.
MAGNETIC RESONANCE AND STRUCTURAL STUDIES OF THERMOCHROMIC COPPER(2) HALIDE SALTS Ph.D. Thesis
Darrel Ray Bloomquist 1980 197 p
Avail: Univ. Microfilms Order No. 8104124

Three thermochromic substituted ammonium chlorocuprate(2) salts were examined using a variety of techniques including DSC X-ray diffraction, H-1 nuclear magnetic resonance, electron paramagnetic resonance and magnetic susceptibility methods. A literature review of inorganic thermochromic materials is presented. Dissert. Abstr.

N81-19244* National Aeronautics and Space Administration. Pasadena Office, Calif.
ION-EXCHANGE HOLLOW FIBERS
Alan Rembaum (JPL), Shiao-Ping S. Yen (JPL), and Elias Klein, inventors (to NASA) (JPL) 16 Mar. 1976 10 p Filed 23 May 1973
(NASA-Case-NPO-13309-1; US-Patent-3,944,485;
US-Patent-Appl-SN-363130; US-Patent-Class-210-24;
US-Patent-Class-260-2.1E; US-Patent-Class-260-2.2R;
US-Patent-Class-264-41) Avail: US Patent and Trademark Office CSCL 07D

An ion-exchange hollow fiber is prepared by introducing into the wall of the fiber polymerizable liquid monomers, and polymerizing the monomers therein to form solid, insoluble, crosslinked, ion-exchange resin particles which embed in the wall of the fiber. Excess particles blocking the central passage or bore of the fiber are removed by forcing liquid through the fiber. The fibers have high ion-exchange capacity, a practical wall permeability and good mechanical strength even with very thin wall dimensions. Experimental investigation of bundles of ion-exchange hollow fibers attached to a header assembly have shown the fiber to be very efficient in removing counterions from solution.

Official Gazette of the U.S. Patent and Trademark Office

N81-19245*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT PIPES TO REDUCE ENGINE EXHAUST EMISSIONS Patent Application
Donald F. Schultz, inventor (to NASA) Filed 30 Jan. 1980 17 p
(NASA-Case-LEW-12590-1; US-Patent-Appl-SN-229693) Avail: NTIS HC A02/MF A01 CSCL 21B

A fuel combustor employing heat transfer devices for improving combustion efficiency and reducing engine exhaust emissions is described. The fuel combustor consists of an elongated casing with an air inlet conduit portion at one end. An elongated heat pipe is mounted longitudinally in the casing and is offset from and extends alongside an intermediate combustion space. The heat pipe is in heating transmitting relationship with the air intake conduit for heating incoming air. A fuel conduit has a portion engaged in heat transfer relationship of the heat pipe for preheating the fuel. The offset position of the heat pipe relative to the combustion space minimizes the quenching effect of the heat pipe on the gaseous products of combustion, as well as reducing coking of the fuel on the heat pipe, thereby improving the efficiency of the combustor. NASA

N81-19246*# California Inst. of Tech., Pasadena. Radiation Lab.
POSSIBLE ISOTOPIC FRACTIONATION EFFECTS IN SPUTTERED MINERALS
P. K. Haff, C. C. Watson, and T. A. Tombrello 1980 36 p refs
(Grants NGR-05-002-333; NSF PHY-79-23638)
(NASA-CR-164042) Avail: NTIS HC A03/MF A01 CSCL 07D

A model which makes definite predictions for the fractionation of isotopes in sputtered material is discussed. The fractionation patterns are nonlinear, and the pattern for a particular set of isotopes depends on the chemical matrix within which those isotopes are contained. Calculations are presented for all nonmonoisotopic elements contained in the minerals perovskite, anorthite, ackermanite, enstatite, and troilite. All isotopes are fractionated at the level of approximately 4-6 deg/o per atomic mass unit. Oxygen is always positively fractionated (heavier isotopes sputtered preferentially), and heavier elements are generally negatively fractioned (light isotopes sputtered preferentially). The value of Delta (O-18:O-16) is always less by about 1.8 deg/o than a linear extrapolation based upon the calculated delta (O-17:O-16) value would suggest. The phenomenon of both negative and positive fractionation patterns from a single target mineral are used to make an experimental test of the proposed model. R.C.T.

N81-19247*# National Aeronautics and Space Administration, Washington, D. C.
STORING HYDROGEN IN THE FORM OF LIGHT ALLOY HYDRIDES
E. Freund and C. Gillerm Mar. 1981 53 p refs Transl. into ENGLISH of "Stockage de l'hydrogene sous forme d'hydrures d'alliages de metaux legers" rept. IFP-26-209 Inst. Francaise du Petrole, Rueil-Malmaison, France, 1978 p 1-58 Translation was announced as N80-17246 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. Francaise du Petrole
(Contract NASw-3199)
(NASA-TM-76526) Avail: NTIS HC A04/MF A01 CSCL 07D

Different hydrides are investigated to find a system with a sufficiently high storage density (at least 3%). The formation of hydrides with light alloys is examined. Reaction kinetics for hydride formation were defined and applied to the systems Mg-Al-H, Mg-Al-Cu-H, Ti-Al-H, Ti-Al-Cu-H, and Ti-Al-Ni-H. Results indicate that the addition of Al destabilizes MgH2 and TiH2 hydrides while having only a limited effect on the storage density. Author

N81-19248*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
HIGH-RESOLUTION LASER ABSORPTION SPECTROSCOPY OF OZONE NEAR 1129.4 cm (-1) Final Report, 25 Oct. 1979 - 24 Oct. 1981
Lawrence N. Majorana Mar. 1981 102 p refs
(Contract NAG1-1)
(NASA-CR-164033; PTR-81-6) Avail: NTIS HC A06/MF A01 CSCL 07D

A Beer's Law experiment was performed with a tunable diode laser to determine self broadened line shape parameters of one infrared absorption ozone line in the nu1 band for ten pressures from 0.26 to 6.29 torr at 285 K. The SO2 line positions were used for wavelength calibration. Line shapes were iteratively fitted to the Voigt function at a Doppler width of 29.54 MHz (HWHM) resulting in values for the integrated line strength, (S), of (0.144 +/- 0.007) x 10 to the minus 20th/cm molecule/cu cm, line center frequency, nu sub o, of 1129.426/cm and the Lorentzian contributions to halfwidth. A linear least squares fit of (alpha sub L)5 as a function of pressure yielded a zero intercept of 15.27 +/- 0.29 MHz (rho = 0.99) and a broadening parameter, (alpha sub L)5, of 5.71 +/- 0.29 MHz/Torr. This results in a line width (FWHM) of 0.144 +/- .007/cm at 760 torr and 285 K. Author

N81-19249*# National Aeronautics and Space Administration, Washington, D. C.
INFRARED ABSORPTION SPECTRA OF METAL CARBIDES, NITRIDES AND SULFIDES
O. Kammori, K. Sato, and F. Kurosawa Feb. 1981 10 p refs Transl. into ENGLISH from Japan Analyst (Japan), v. 17, 1968 p 1270-1273 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Tokyo Research Inst. and Yawata Iron and Steel Co. Ltd., Tokyo
(Contract NASw-3199)
(NASA-TM-75900) Avail: NTIS HC A02/MF A01 CSCL 07D

The infrared absorption spectra of 12 kinds of metal carbides, 11 kinds of nitrides, and 7 kinds of sulfides, a total of 30 materials, were measured and the application of the infrared spectra of these materials to analytical chemistry was discussed. The measurements were done in the frequency (wave length) range of (1400 to 400/cm (7 to 25 mu). The carbides Al4C3, B4C, the nitrides AlN, BN, Si3N4, WB, and the sulfides Al2S3, FeS2, MnS, NiS and PbS were noted to have specific absorptions in the measured region. The sensitivity of Boron nitride was especially good and could be detected at 2 to 3 micrograms in 300 mg of potassium bromide. Author

N81-19250# Universidad Politecnica de Madrid (Spain). Lab. of Fluid Mechanics.
ASYMPTOTIC TECHNIQUES IN IGNITION THEORY Final Technical Report, Dec. 1978 - Mar. 1980
Manuel Kindelan and Amable Linan Dec. 1980 64 p ref
(Grant DA-ERO-79-G-0007; DA Proj. 1T1-61102-BH-5706)
(AD-A094035) Avail: NTIS HC A04/MF A01 CSCL 21/2

An analysis is given for the ignition of a reactive material by an electrical wire heated at constant power. The wire temperature history is described for small and large values of the electrical heating rate and for solid and gaseous reactants; in the case of gaseous reactants the effects of convection have also been taken into account. The results of the analysis include closed form expression for the ignition time in terms of the physicochemical parameters. GRA

N81-19251# Dayton Univ., Ohio.
NON-AQUEOUS ELECTRODE RESEARCH Final Technical Report, 1 Oct. 1977 - 25 Jul. 1980
R. G. Keil, William E. Moddeman, T. N. Wittberg, J. R. Hoenigman, and P. S. Zaidain Wright-Patterson AFB, Ohio AFWAL Oct. 1980 104 p refs
(Contract F33615-77-C-3156; AF Proj. 2303)
(AD-A094699; UDR-NM-TR-80-27; AFWAL-TR-80-2094) Avail: NTIS HC A06/MF A01 CSCL 07/4

The faradaic and non-faradaic reactivity of lithium in the thionyl chloride battery system has been studied using AES, XPS, and SEM/EDAX. The passivating film has been characterized as lithium chloride and found to contain substantial quantities of aluminum and sulfur. XPS results show definitely that in battery discharged lithium sulfur occluded within the passive film is present in multiple oxidation states, including sulfide. The reactivity of the lithium metal surface with O2, CO2, CO, and N2 was studied. The 'black spots' were synthesized and analyzed

as a lithium oxynitride. A model for ion transport across the passivating lithium chloride film was postulated and its implications discussed. The current interrupt method was tested on a model system. An A/D interface and associated software was developed to enable rapid, accurate data acquisition. GRA

N81-19252# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.

DETAILED MODELING OF COMBUSTION: A NON-INTERFERING DIAGNOSTIC TOOL Interim Report

E. S. Oran, J. P. Boris, and M. J. Fritts 19 Jan. 1981 48 p refs

(AD-A094896; NRL-MR-4427) Avail: NTIS HC A03/MF A01 CSCL 21/2

A major goal of detailed numerical modeling of combustion is to develop computational tools which can be used interactively with laboratory diagnostic techniques to interpret and understand experiments. Only through this quantitative interaction of prediction and measurement can we calibrate convincingly our understanding of the fundamental physical and chemical processes involved. Modeling of flames and detonations is particularly challenging because of the strong feedback between the energy released due to chemical reactions and the evolution of the hydrodynamic flow. Since it is generally not possible to decouple these processes completely, special numerical techniques are required to solve the problems. In this paper, the basic steps and decisions which must be made when constructing and using a numerical model will be discussed. These involve choosing the numerical algorithms based on the physics and chemistry of the problem, testing the model based on these algorithms in different limits against theoretical and analytical results, and using the model interactively with experiments. With the third step specifically in mind, it will be shown how the species concentration, velocity, and temperature profiles obtained from laser probe diagnostics can provide information for use in and comparison with detailed calculations. GRA

N81-19253# IBM Research Lab., San Jose, Calif.

WORKSHOP ON RECENT EXPERIMENTAL AND THEORETICAL APPROACHES TO THE STUDY OF THE ELECTRICAL DOUBLE LAYER Final Report

Douglas Henderson, L. Blum (Puerto Rico Univ.), R. Fawcett (Guelph Univ., Ontario), J. Gordon, III, and R. Parsons (CNRS, Bellevue, France) 1980 13 p Workshop held at San Jose, Calif., 23-25 Jul. 1980

(Contract F49620-80-C-0062; AF Proj. 2303)

(AD-A094790; AFOSR-81-0020TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

A small group of scientists interested in fundamental and applied problems related to the electrical double layer were brought together. The workshop consisted of twelve reviews and a panel discussion. The report includes specific recommendations for future work. GRA

N81-19254# University of Southern California, Los Angeles.

NITRATION AND HIGH ENERGY NITROGEN COMPOUNDS Summary Research Report, 15 Jul. 1977 - 14 Oct. 1980

George A. Olah 15 Jan. 1981 9 p refs

(Grants DAAG29-77-G-0173; DAAG29-78-G-0106)

(AD-A095074; ARO-15156.6-C) Avail: NTIS HC A02/MF A01 CSCL 07/3

Electrophilic nitration of aromatics with a wide variety of nitrating systems were carried out to elucidate the general mechanism of the reaction. The study with reactive nitrating agents clearly reinforce our earlier view that substrate and positional selectivity are determined in two separate steps. Studies on the nitration of naphthalene show that the suggested radical cation pair mechanism is not of general importance. The reversibility of electrophilic aromatic nitration was demonstrated using superacid catalysts. Transfer nitrations were carried out with various transfer nitrating agents including preparation of nitrite esters of polyols. Solid superacid catalyzed nitration of aromatics with various nitrating agents was developed. The ambident reactivity of nitronium ion was demonstrated in the reaction of sulfides, selenides and phosphines using 13C, 15N and 31P NMR spectroscopy. GRA

N81-19255# Air Force Academy, Colo.

THEORETICAL MODELING OF SCOT COLUMNS Final Report, 1 Jul. 1957 - 30 Sep. 1980

Robert H. Foglesong Dec. 1980 15 p refs

(AF Proj. 2303)

(AD-A094707; FJSRL-TR-80-0019) Avail: NTIS HC A02/MF A01 CSCL 07/4

A description of the thermodynamic processes that occur within a SCOT column is presented. The unique geometry of the SCOT column was found to slightly alter the mathematical description of the thermodynamic phenomena as compared to the traditional packed column. The correlation derived from this thermodynamic description was used to determine experimental values for the heats of vaporization and boiling points for several light alcohols to verify its usefulness and validity. GRA

N81-19256# Air Force Academy, Colo.

PROGRESS REPORT ON RESEARCH INTO CHEMICAL STRUCTURE/BONDING DECOMPOSITION RELATIONSHIPS FOR ENERGETIC MATERIALS Interim Technical Report

R. Cameron Dorey, John S. Wilkes, Larry P. Davis, Henry L. Pugh, W. Robert Carper, Almon G. Turner, and Kenneth E. Siegenthaler Dec. 1980 38 p refs

(AF Proj. 2303)

(AD-A095134; FJSRL-TR-80-0026) Avail: NTIS HC A03/MF A01 CSCL 07/4

Photochemical and thermal decomposition of nitroaromatic compounds and nitramines have been studied by electron paramagnetic resonance spectroscopy. Radicals are obtained from both types of compounds, indicating a mechanism for their decomposition. Photolysis of nitroaromatics in ethers results in a radical produced with solvent interaction, whereas photolysis in other solvents and all photolysis of nitramines produces a radical formed by cleavage of a nitro group from the parent compound. Thermal decomposition studies have been undertaken using binary mixtures of compounds in the search for an inert high temperature solvent. GRA

N81-19257# Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.

RECENT ADVANCES IN THE SCIENCES OF ELECTROCATALYSIS

Ernest Yedger 1 Nov. 1980 60 p refs Presented at the Acheson Natl. Meeting of the Electrochem. Soc., Cleveland, Oct. 1980

(Contract N00014-75-C-0953; NR Proj. 359-451)

(AD-A095095; TR-52) Avail: NTIS HC A04/MF A01 CSCL 07/4

This paper was presented as the Acheson Award lecture at the national meeting of the Electrochemical Society in October 1980 and surveys recent developments in the field of electrocatalysis, including work in the author's laboratory, most of which was carried out with the support of ONR. The first part surveys techniques for obtaining information concerning electrode surfaces and particularly species adsorbed on such surfaces. Special attention is focused on in-situ optical techniques (ultraviolet, visible, infrared, Raman) and the use of ex-situ surface physics techniques, the latter in conjunction with electrochemical studies of single crystal electrode surfaces. The second part of the paper summarizes the present state of understanding of hydrogen and oxygen electrocatalysis. GRA

N81-19258# Gulf Research and Development Co., Pittsburgh, Pa.

INVESTIGATION OF MECHANISM OF HYDROGEN TRANSFER IN COAL HYDROGENATION Quarterly Progress Report, Mar. - May 1980

D. C. Cronauer and R. G. Ruberto Jul. 1980 18 p refs

(Contract DE-AC22-80PC-30080)

(DOE/PC-30080/T1) Avail: NTIS HC A02/MF A01

Emphasis is upon both hydrogen transfer fundamentals, namely, observing the rate of conversion, rate of hydrogen transfer, and the site of hydrogen transfer, and upon refining the techniques to measure hydrogen donor capacity. A kinetic model was prepared which correlates the data of the liquefaction of two types of coals in the presence of good and poor hydrogen donor solvents. This single kinetic model, which includes the reaction of coal +

solvent (oil) yields more reaction coal, adequately explains the observed phenomena of a net consumption of solvent (for poor donor solvents) at low space times. T.M.

N81-19259# Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.

GAS TURBINE COMBUSTOR PERFORMANCE ON SYNTHETIC FUELS, VOLUME 1 Final Report

S. M. DeCorso, P. W. Pillsbury, G. Bauserman, P. R. Mulik, and T. R. Stein Nov. 1980 66 p Sponsored by Electric Power Research Inst.

(EPRI Proj. 989-1)

(EPRI-AP-1623-Vol-1) Avail: NTIS HC A04/MF A01

The effects of burning coal and shale derived synthetic liquid in state of the art gas turbine combustors were determined. Ten types of coal derived liquid fuels from the SRC-I, SRC-II, EDS, and H-Coal processes, and three hydrogenated shale oil fuels were utilized. The combustion and emission performance of fuels other than petroleum was obtained. Synthetic fuels burned approximately as expected from extrapolation of the combustion results obtained with petroleum fuels. It was concluded that synthetic fuels with hydrogen content approximately 0.2% should be satisfactory for engines of current design. All fuels were landled acceptably by standard fuel forwarding systems. Emissions of CO, UHC and particulates were at about the same low levels as for petroleum distillate No. 2. analysis and correlation of NO sub x emissions and wall temperatures versus fuel properties were developed for prediction of these effects over a range of operating conditions. DOE

N81-19260# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.

NMR STUDY OF VISCOELASTIC FLUIDS AND ELASTOMERS UNDER EXTREME CONDITIONS OF TEMPERATURE AND PRESSURE Final Report

Jiri Jonas 30 Sep. 1980 23 p refs

(Grant AF-AFOSR-3185-77; AF Proj. 2303)

(AD-A094513; AFOSR-81-0006TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The project dealt with the investigation of the dynamic structure of three main disordered systems: (1) viscous fluids; (2) ionic mesophases of melts of alkali metal carboxylates; and (3) selected polymer systems. The results obtained carried us towards our long term goal of better understanding the relationship between the molecular behavior and the macroscopic properties of the system studied. Our experiments on fluids help to bridge the current gap between molecular dynamics and hydrodynamics. In addition, considerable effort was devoted to the development of new instrumentation necessary for NMR experiments at extreme conditions of pressure and temperature. In the case of viscous fluids, new insights have been gained concerning applicability of hydrodynamic equations at the molecular level. In the studies of alkali metal carboxylates, our research efforts have focused on the dynamic structure of the mesophase and solid of sodium isovalerate and sodium n-butyrate. Analogies existing in the Na23 NMR data between the superionic conductor, sodium beta-alumina, and solid sodium n-butyrate suggest solid sodium n-butyrate to resemble a fast ion conductor. The exploratory experiments on elastomers dealt mainly with polybutadienes investigating various dynamic properties of elastomers under extreme conditions of high temperature and high pressure. GRA

N81-19261# Sandia Labs., Albuquerque, N. Mex.

HYDROGEN GETTER INHIBITION BY A LOCALIZED POLYMERIZATION PROCESS

R. E. Trujillo Dec. 1980 38 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-2588) Avail: NTIS HC A03/MF A01

Catalytic hydrogenation of alkynes by palladium was used in removing hydrogen from closed systems. Dimerized phenylpropargyl ether (DPPE) coated on an aluminum oxide substrate containing 5% palladium represents a typical hydrogen getter were recovered from prototype weapon system components and were found to have impaired hydrogenation efficiency. Studies described in this report suggest that the loss of hydrogenation efficiency may result from localized polymerization occurring at the catalyst substrate interface. This process is characterized by polymerization of 6% of the DPPE to a polymer product of low molecular weight, occurs at temperatures below the melting point of DPPE, and requires the presence of palladium catalyst in order to occur. DOE

N81-19262# Sandia Labs., Livermore, Calif. Combustion Sciences Dept.

OH CONCENTRATION IN AN ATMOSPHERIC-PRESSURE METHANE-AIR FLAME FROM MOLECULAR-BEAM MASS SPECTROMETRY AND LASER-ABSORPTION SPECTROSCOPY

R. J. Cattolica, S. Yoon, and E. L. Knuth Dec. 1980 41 p refs Presented at the Western States Sect. of the Combust. Inst. Fall 1980 Meeting, Los Angeles Prepared in cooperation with California Univ., Los Angeles

(Contract DE-AC04-76DP-00789; Grant NSF ENG-77-9190)

(SAND-80-8804; CONF-8010104-4) Avail: NTIS HC A03/MF A01

The concentration of the OH radical in a stoichiometric methane-air flat flame at atmospheric pressure was measured with both laser absorption spectroscopy and molecular beam mass spectrometry (MBMS). The nonequilibrium peak OH concentrations and the OH decay rate measured from the two techniques were in good agreement. The OH profile from the MBMS measurements, however, was shifted downstream from the absorption measurements by approximately 5 times the sampling orifice diameter. A comparison of temperature profiles from thermocouple measurements and from a molecular beam time of flight technique exhibited a similar downstream shift. The MBMS measurements effectively sampled the gas properties approximately five orifice diameters ahead of the sampling-probe tip. Perturbation of the OH concentration profile using various sampling probes indicate the importance of minimizing the length of the sampling orifice channel to reduce composition relaxation during sampling. DOE

N81-19263# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.

VISCOSITY OF NaCl AND OTHER SOLUTIONS UP TO 350 DEG C AND 50 MPa PRESSURES

S. L. Phillips, H. Ozbek, A. Igvene, and G. Litton Nov. 1980 80 p refs Presented at the 2nd Chem. Congr. of the North Am. Continent, Las Vegas, 24-29 Aug. 1980

(Contract W-7405-eng-48)

(LBL-11586; CONF-800814-30) Avail: NTIS HC A05/MF A01

Experimental values for the viscosity of sodium chloride solutions are critically reviewed for application to geothermal energy. Data published recently by Kestin, Los, Pepinov, and Semenyuk as well as earlier data are included. A theoretically based equation for calculating relative viscosity was developed, and used to generate tables of smoothed values over the ranges 20(0) C to 350 (0) C, 0 to 5 m and pressures up to 50 MPa. The equation reproduces selected data to an average of better than 2 percent over the entire range of temperatures and pressures. Selected tables of data are included for KCl up to 150(0) C, CaCl2 solutions up to 100(0) C, and for mixtures of NaCl with KCl and CaCl2. Recommendations are given for additional data needs. DOE

N81-19264# Polytechnic Inst. of New York, Farmingdale. Dept. of Mechanical and Aerospace Engineering.

COMBUSTION OF A SOLID PARTICLE

Moshe Matalon (Northwestern Univ., Evanston, Ill.) 1980 30 p refs

(Contracts DE-AC02-78ET-11056; ET-78-C-01-3084)

(DOE/ET-11056/T2) Avail: NTIS HC A03/MF A01

The quasi-steady burning of a carbon particle which undergoes gasification at its surface by chemical reactions, followed by a homogeneous reaction in the gas phase is considered. The burning rate M is found as a function of the gas phase Damkoehler number D(sub g) for the whole range 0 < D(sub g) < infinity. The monotonic M(D(sub g)) curve, obtained for relatively very hot or very cold particles, describes the gradual transition from frozen flow to equilibrium. For moderate particle temperatures the transition is abrupt and the M(D(sub g)) curve is either S shaped or Z shaped. In the former the burning is enhanced at ignition while in the latter it is slowed down; this depends on the relative importance of the two competitive surface reac-

tions. At extinction, the reverse is true; burning is slowed down in the case of an S curve and is enhanced in the case of a Z curve. DOE

N81-19265# Michigan Technological Univ., Houghton. Center for Waste Management Programs.
COAL COMBUSTION BY WET OXIDATION
Jeffrie A. Bettinger, Richard A. Lamparter, and Deborah C. McDowell 15 Nov. 1980 201 p refs
(Contract DE-FG22-78ET-12328)
(DOE/ET-12328/T2) Avail: NTIS HC A10/MF A01

In wet oxidation a combustible material such as coal is reacted with oxygen in the presence of liquid water. The reaction is typically carried out in the range of 204 C to 353 C with sufficient pressure to maintain the water present in the liquid state, and provide the partial pressure of oxygen in the gas phase necessary to carry out the reaction. Experimental studies to explore the key reaction parameters of temperature, time, oxidant, catalyst, coal type, and mesh size were conducted by running batch tests in a one gallon stirred autoclave. The factors exhibiting the greatest effect on the extent of reaction were temperature and residence time. The effect of temperature was studied from 204 C to 260 C with a residence time from 600 to 3600 seconds. From this data, the reaction activation energy of 727,000 calories per mole was determined for a high volatile A Bituminous type coal. The reaction energy using the Arrhenius equation. Additional data were generated on the effect of mesh size and different coal types. DOE

N81-19266# Tennessee Univ., Tullahoma. Energy Conversion Div.
INVESTIGATION OF SWIRLING FLOW MIXING FOR APPLICATION IN AN MHD PULVERIZED COAL COMBUSTOR USING ISOTHERMAL MODELING M.S. Thesis Interim Report
William H. Power May 1980 81 p refs
(Contract DE-AC02-79ET-10815)
(DOE/ET-10815/39) Avail: NTIS HC A05/MF A01

A one fourth dimensionally scaled combustor model was developed for isothermal flow testing. A comparison was made of cold flow tests using 3 swirler designs with a base case oxidizer injector design of perforated plated which demonstrated acceptable performance in the 4 lbm/sec MHD combustor. The three swirlers that were evaluated were designed to allow a wide range of swirl intensity to be investigated. The design criterion of the swirler was the swirl number which has been related to swirler geometry. The results of the study showed that the swirlers that were tested fell short of the mixing characteristics displayed with the perforated plate base case oxidizer injector. The data obtained with the cold flow model established that the actual swirl numbers of two of the swirlers were much lower than the design swirl numbers. Recirculation zones were defined for all configurations that were tested, and a comparison of velocity profiles was made for the configurations. DOE

N81-19267# Martin Marietta Labs., Baltimore, Md.
MASS SPECTROMETRIC STUDIES OF HYDRAZINE PHOTOOXIDATION BY ILLUMINATED CHLOROPLASTS
Richard Radmer and Otto Ollinger 1980 27 p refs
(Contract DE-AC02-76ER-03326)
(DOE/ER-03326/T2) Avail: NTIS HC A03/MF A01

Mass Spectrometric techniques were used to directly monitor the products evolved during the course of hydrazine (NH_2NH_2) photooxidation by chloroplasts exposed to short saturating flashes or continuous high light. Our results indicate that hydrazine can be used as a reliable probe of Photosystem II provided that (a) N_2 evolution (rather than O_2 uptake) is monitored, and (b) precautions are taken to minimize spurious side reactions. Under conditions in which the participation of superoxide is minimized, N_2 evolution accurately reflects the photooxidation of hydrazine by photosystem II. DOE

N81-19268# Teledyne Energy Systems, Timonium, Md.
ADVANCED ALKALINE WATER ELECTROLYSIS: MODEL FOR ALKALINE WATER ELECTROLYSIS SYSTEMS
M. R. Yaffe and J. N. Murray Apr. 1980 150 p refs Prepared for Brookhaven National Lab.
(Contract DE-AC02-76CH-00016)
(BNL-51276) Avail: NTIS HC A07/MF A01

Task 2 involved establishment of an engineering and economic model for the evaluation of various options in water electrolysis. The mode, verification of the specific coding and four case studies are described. The model was tested by evaluation of a nearly commercial technology, i.e., an 80-kW alkaline electrolyte system, operating at 60(0)C, which delivers approximately 255 SLM, hydrogen for applications such as electrical generation cooling or semiconductor manufacturing. The calculated cost of hydrogen from this installed non-optimized case system with an initial cost to the customer of $87,000 was $6.99/Kg H2 ($1.67/100 SCF) on a 20-yr levelized basis using 2.5 cents/kWh power costs. This compares favorably to a levelized average mechant hydrogen cost value of $9.11/Kg H2 ($2.17/100 SCF) calculated using the sampe program. DOE

N81-19269*# National Bureau of Standards, Washington, D.C. National Engineering Lab.
INTERACTIVE FORTRAN IV COMPUTER PROGRAMS FOR THE THERMODYNAMIC AND TRANSPORT PROPERTIES OF SELECTED CRYOGENS (FLUIDS PACK)
R. D. McCarty Oct. 1980 116 p refs Sponsored by NASA. Johnson Space Center
(NASA-CR-164016; PB81-125809; NBS-TN-1025) Avail: NTIS HC A06/MF A01 CSCL 07D

The thermodynamic and transport properties of selected cryogens had programmed into a series of computer routines. Input variables are any two of P, rho or T in the single phase regions and either P or T for the saturated liquid or vapor state. The output is pressure, density, temperature, entropy, enthalpy for all of the fluids and in most cases specific heat capacity and speed of sound. Viscosity and thermal conductivity are also given for most of the fluids. The programs are designed for access by remote terminal; however, they have been written in a modular form to allow the user to select either specific fluids or specific properties for particular needs. The program includes properties for hydrogen, helium, neon, nitrogen, oxygen, argon, and methane. The programs include properties for gaseous and liquid states usually from the triple point to some upper limit of pressure and temperature which varies from fluid to fluid. GRA

N81-19270# Gulf South Research Inst., New Orleans, La.
MEMBRANE AND MATERIALS EVALUATION Final Report, 15 Mar. 1979 - 26 Jun. 1980
E. Klein, F. F. Holland, Jr., H. E. Gidden, K. Eberle, and R. P. Wendt 7 Nov. 1980 64 p refs
(PB81-122681; AK-7-2-2221-F; Rept-323-579-18) Avail: NTIS HC A04/MF A01 CSCL 07D

An overview of eight years' work is given with citations to annual reports and publication in the literature. Work covered in the last contract year included trace metal protein binding, separation of uremic middle molecules and hemofilter mass transfer. Work on hemofilters includes a mass transfer model developed using a uniform wall flux boundary layer theory and the Kadem-Speigler equation to project ultrafiltration flux and solute clearance. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-19271 Cornell Univ., Ithaca, N. Y.
INELASTIC DEFORMATION AND PHENOMENOLOGICAL MODELING OF ALUMINUM INCLUDING TRANSIENT EFFECT Ph.D. Thesis
Chul-Won Cho 1980 248 p
Avail: Univ. Microfilms Order No. 8102970

A new inelastic deformation theory was proposed to account for the shortcomings of Hart's theory by introducing the concept of microplasticity. The new model consists of five deformation elements: friction element representing a deformation element controlled by dislocation glide; a nonrecoverable plastic element representing the dislocation leakage rate over the strong dislocation barriers; a microplastic element representing the dislocation leakage rate over the weak barriers; a short range

anelastic spring element representing the recoverable anelastic strain stored by piled up dislocations against the weak barriers; and a long range anelastic spring element representing the recoverable strain stored by piled up dislocations against the strong barriers. To determine the material parameters for the plastic element and the friction element, the method of load relaxation and tensile testing in the plastic range was used.
Dissert. Abstr.

N81-19272 University of Southern Illinois at Carbondale.
DONNAN DIALYSIS APPROACHES TO METAL ANALYSIS IN NATURAL SAMPLES Ph.D. Thesis
Zbigniew Twardowski 1980 103 p
Avail: Univ. Microfilms Order No. 8102433

The efficacy of Donnan dialysis for removal of interferences by surfactants, complexing agents, and electroactive organic compounds on anodic stripping voltammetry and differential pulse polarography was demonstrated. Up to a least 0.05% gelatin and 0.01% Triton X-100 did not alter the rate of dialysis of Cd(2), Pu(2), Cu(2), and Zn(2). As the ion exchange membrane is not permeable to these surfactants, the subsequent voltametric determination can be performed by a working curve method. Recoveries of metals from a variety of real samples were generally above 90%. The presence of 50 mg humic acid/L did not alter the transport of Cu(2) from pH 3 solution but did at pH8. The transport was related to the free and labile-complexed ion concentrations which suggests that Donnan dialysis can be used for speciation investigations as well as for enrichment and matrix normalization. Pumping the receiver through Nafion 811 cation-exchange tubing yields more efficient Donnan dialysis enrichments than the used of unstirred receiver systems.
Dissert. Abstr.

N81-19273*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CREEP AND RESIDUAL MECHANICAL PROPERTIES OF CAST SUPERALLOYS AND OXIDE DISPERSION STRENGTHENED ALLOYS
J. Daniel Whittenberger Feb. 1981 69 p refs
(NASA-TP-1781; E-472) Avail: NTIS HC A04/MF A01 CSCL 11F

Tensile, stress-rupture, creep, and residual tensile properties after creep testing were determined for two typical cast superalloys and four advanced oxide dispersion strengthened (ODS) alloys. The superalloys examined included the nickel-base alloy B-1900 and the cobalt-base alloy MAR-M509. The nickel-base ODS MA-757 (Ni-16CR-4Al-0.6Y2O3 and the iron-base ODS alloy MA-956 (Fe-20Cr-5Al-0.8Y2O3) were extensively studied, while limited testing was conducted on the ODS nickel-base alloys STCA (Ni-16Cr-4.5Al-2Y2O3) with a without Ta and YD-NiCrAl (Ni-16Cr-5Al-2Y2O3). Elevated temperature testing was conducted from 114 to 1477 K except for STCA and YD-NiCrAl alloys, which were only tested at 1366 K. The residual tensile properties of B-1900 and MAR-M509 are not reduced by prior creep testing (strains at least up to 1 percent), while the room temperature tensile properties of ODS nickel-base alloys can be reduced by small amounts of prior creep strain (less than 0.5 percent). The iron-base ODS alloy MA-956 does not appear to be susceptible to creep degradation at least up to strains of about 0.25 percent. However, MA-956 exhibits unusual creep behavior which apparently involves crack nucleation and growth. Author

N81-19274*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF SEVERAL CORROSION PROTECTIVE COATING SYSTEMS ON ALUMINUM
R. H. Higgins Feb. 1981 20 p
(NASA-TM-82402) Avail: NTIS HC A02/MF A01 CSCL 11F

A study of several protective coating systems for use on aluminum in seawater/seacoast environments was conducted to review the developments made on protective coatings since early in the Space Shuttle program and to perform comparative studies on these coatings to determine their effectiveness for providing corrosion protection during exposure to seawater/seacoast environments. Panels of 2219-T87 aluminum were coated with 21 different systems and exposed to a 5 percent salt spray for 4000 hr. Application properties, adhesion measurements, heat resistance and corrosion protection were evaluated. For comparative studies, the presently specified Bostik epoxy system used on the SRB structures was included. Results of these tests indicate four systems with outstanding performance and four additional systems with protection almost as good. These systems are based on a chromated pretreatment, a chromate epoxy primer, and a polyurethane topcoat. Consideration for one of these systems should be included for those applications where superior corrosion protection for aluminum surfaces is required. Author

N81-19275*# Grumman Aerospace Corp., Bethpage, N.Y.
THE GROWTH OF METASTABLE PERITECTIC COMPOUNDS Annual Report
David J. Larson, Jr. and Ron G. Pirich (Clarkson Coll. of Technology) Jan. 1981 51 p refs
(Contract NAS8-32998)
(NASA-CR-161670; RM-714) Avail: NTIS HC A04/MF A01 CSCL 11F

The influence of gravitationally driven thermosolutal convection on the directional solidification of peritectic alloys is considered as well as the relationships between the solidification processing conditions, and the microstructure, chemistry, and magnetic properties of such alloys. Analysis of directionally solidified Pb-Bi peritectic samples indicates that appreciable macrosegregation occurs due to thermosoluta convection and/or Soret diffusion. A peritectic solidification model which accounts for partial mixing in the liquid ahead of the planar solidification interface and describes macrosegregation has been developed. Two-phase dendritic and banded microstructures were grown in the Pb-Bi peritectic system, refined two-phase microstructures have were observed, and candidate formation mechanisms proposed. Material handling, containment, casting, microstructural and magnetic characterization techniques were developed for the Sm-Co system. Alloys produced with these procedures are homogeneous. A.R.H.

N81-19276*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CORROSION OF 310 STAINLESS STEEL IN H2-H2O-H2S GAS MIXTURES: STUDIES AT CONSTANT TEMPERATURE AND FIXED OXYGEN POTENTIAL
D. Bhogeswara Rao (California Univ., Lawrence Berkeley Lab.), K. T. Jacob (California Univ., Berkeley), and Howard G. Nelson Feb. 1981 40 p refs
(NASA-TM-81242; A-8349) Avail: NTIS HC A03/MF A01 CSCL 11F

Corrosion of SAE 310 stainless steel in H2-H2O-H2S gas mixtures was studied at a constant temperature of 1150 K. Reactive gas mixtures were chosen to yield a constant oxygen potential of approximately 6 x 10 to the minus 13th power/cu Nm and sulfur potentials ranging from 0.19 x 10 to the minus 2nd power/cu Nm to 33 x 10 to the minus 2nd power/cu Nm. The kinetics of corrosion were determined using a thermobalance, and the scales were analyzed using metallography, scanning electron microscopy, and energy dispersive X-ray analysis. Two corrosion regimes, which were dependent on sulfur potential, were identified. At high sulfur potentials (p sub S sub 2 less than or equal to 2.7 x 10 to the minus 2nd power/cu Nm) the corrosion rates were high, the kinetics obeyed a linear rate equation, and the scales consisted mainly of sulfide phases similar to those observed from pure sulfication. At low sulfur potentials (P sub S sub 2 less than or equal to 0.19 x 10 to the minus 2nd power/cu Nm) the corrosion rates were low, the kinetics obeyed a parabolic rate equation, and scales consisted mainly of oxide phases. Author

N81-19277*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
TURBINE BLADE TEMPERATURE MEASUREMENTS USING THIN FILM TEMPERATURE SENSORS
H. P. Grant, J. S. Przybyszewski, and R. G. Claing 17 Mar. 1981 65 p refs
(Contract NAS3-20831)
(NASA-CR-165201; PWA-5604-31) Avail: NTIS HC A04/MF A01 CSCL 11F

The development of thin film temperature sensors is discussed. The technology for sputtering 2 micron thin film platinum versus platinum 10 percent rhodium thermocouples on alumina forming

coatings was improved and extended to applications on actual turbine blades. Good adherence was found to depend upon achieving a proper morphology of the alumina surface. Problems of adapting fabrication procedures to turbine blades were uncovered, and improvements were recommended. Testing at 1250 K at one atmosphere pressure was then extended to a higher Mach No. (0.5) in combustor flow for 60 hours and 71 thermal cycles. The mean time to failure was 47 hours accumulated during 1 hour exposures in the combustor. Calibration drift was about 0.1 percent per hour, attributable to oxidation of the rhodium in the thin films. An increase in film thickness and application of a protective overcoat are recommended to reduce drift in actual engine testing. M.G.

N81-19278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SIMULTANEOUS ION SPUTTER POLISHING AND DEPOSITION

Sharon Rutledge, Bruce Banks, and Marko Brdar (Akron Univ.) Jan. 1981 20 p refs

(NASA-TM-81679; E-705) Avail: NTIS HC A02/MF A01 CSCL 11F

Results of experiments to study ion beam sputter polishing in conjunction with simultaneous deposition as a mean of polishing copper surfaces are presented. Two types of simultaneous ion sputter polishing and deposition were used in these experiments. The first type utilized sputter polishing simultaneous with vapor deposition, and the second type utilized sputter polishing simultaneous with sputter deposition. The etch and deposition rates of both techniques were studied, as well as the surface morphology and surface roughness. Author

N81-19279# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.

FATIGUE AND MICROSTRUCTURAL PROPERTIES OF QUENCHED Ti-6Al-4V: A CRYSTALLOGRAPHIC STUDY OF FATIGUE IN TITANIUM CORROSION AND CORROSION FATIGUE BEHAVIOR OF Ti-5Al-5Mo (CORONA 5) AND Ti-6Al-4V Ph.D. Thesis. Final Report

C. M. Gilmore, M. A. Iman, M. Sugano, K. M. Speck, and A. C. Fraker Sep. 1980 101 p refs

(Contract N00019-78-C-0269)

(AD-A094197; TR-5) Avail: NTIS HC A06/MF A01 CSCL 11/6

The mechanical properties and microstructures of Ti-6Al-4V were determined for specimens heat treated at temperatures from 84 C to 1065 C for 10 minutes and water quenched; these properties were compared with those of alpha:-Beta annealed specimens. Specimens heat treated at 900 C and water quenched had higher fatigue lives by a factor of four to ten relative to the other treatments, in addition this treatment resulted in high ductility, yield strength, tensile strength and elastic modulus. Microstructure studies utilizing optical and transmission microscopy showed that the improved fatigue lives were a result of strain induced transformation of retained beta to alpha: martensite. Isothermal aging of as quenched specimens reduced the fatigue lives and the retained beta was thermally activated to transform to alpha: martensite. the beta to alpha: martensite transformation observed was therefore an isothermal martensite transformation whereas it is presently assumed that this transformation is always athermal. The amount of retained beta and its relative stability was shown to depend upon the heat treatment temperature. GRA

N81-19280# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

AN EXPERIMENTAL EVALUATION OF THE MECHANICAL RESPONSE CHARACTERISTICS OF RENE 95 Interim Report, Sep. 1978 - Apr. 1980

D. C. Stouffer, L. Papernik, and H. L. Bernstein Oct. 1980 77 p refs

(Contract F33615-78-C-5199; AF Proj. 2307)

(AD-A094466; AFWAL-TR-80-4136) Avail: NTIS HC A05/MF A01 CSCL 11/6

The mechanical responses of thermomechanically processed cast and wrought Rene 95 at 650C (1200 F) was studied. The experimental program included: tensile and compressive tests at different constant strain rates, creep in tension at and compression at twelve stress levels, strain recovery, stress relaxation, creep response to a sequence of step stress histories and fatigue under load control. The results are important for the understanding of the material response characteristics and for the development of a realistic constitutive model. Most of the tests were done in tension and data was used to evaluate various constitutive assumptions. It was shown that the engineering stress-strain response is relatively insensitive to changes in strain rate at rates above 5%/min. It was also shown that the compressive stress-strain response is about 10% stiffer than the tensile response and the minimum creep rate in compression. The hysteresis loop developed a mean tensile strain. It was found that the logarithm of the minimum creep rate is linear in the true stress and that creep and stress relaxation can be correlated using isochronous creep curves. The minimum creep rate is also independent of step changes in the stress history. GRA

N81-19281# United Technologies Research Center, East Hartford, Conn.

A STUDY OF THE DEPENDENCE OF MICROSEGREGATION ON CRITICAL SOLIDIFICATION PARAMETERS IN RAPIDLY-QUENCHED STRUCTURES Annual Technical Report, 1 Aug. 1979 - 30 Sep. 1980

L. E. Greenwald, H. L. Fraser, M. J. Kaufman, and E. M. Breinan Dec. 1980 47 p refs

(Contract N00014-79-C-0649)

(AD-A094325; UTRC/R80-914763-3) Avail: NTIS HC A03/MF A01 CSCL 11/6

The aims of the present program were to determine both experimentally and analytically the cooling rates experienced by material during laser melting in the deep penetration and shallow penetration melting modes, to determine the microstructures and degrees of microsegregation associated with these cooling rates, to correlate the structure and segregation with weld cracking behavior, and to eventually determine the mechanism involved in weld cracking. A literature survey was performed and two new mathematical models were developed, a two dimensional model for deep penetration welding and a one dimensional model for shallow penetration surface melting. The results of both model calculations were eventually verified by experimental tests and comparisons of results, with excellent agreement being obtained for the deep penetration model and adequate agreement being obtained for the shallow penetration model. In addition a series of three special Ni-Al-Mo alloys was weld-crack tested to determine effects of microstructure on cracking behavior. GRA

N81-19282# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.

ADIABATIC SHEARING IN FERROUS ALLOYS Final Report, 1 Oct. 1979 - 30 Sep. 1980

H. C. Rogers 1 Jan. 1981 18 p refs

(Contract DAAG29-79-C-0105; Grant DAAG29-77-G-0137)

(AD-A095150; ARO-14651.1-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

The dynamic deformation studies were carried out using a modified compressed air gun at Drexel University. The flat-nosed projectiles were made of hardened tool steel approximately 0.8 inches in diameter and weighing about 0.25 lb. For the most part the projectiles were 'stepped'. In other words, the actual penetration attempt of the plate targets was made by a short cylindrical flat-nosed step at the front of the projectile. This step gave the relatively heavy projectile a better chance of penetrating the target at the relatively low velocities that could be generated by the air gun. It also limited the penetration to the height of the step or less. The targets were 1/4 inch to 5/16 inch plates, cut either from plate material of that thickness or removed from 1 inch rounds, depending on availability. Preliminary tests showed that for the materials studied there is no significant orientation effect relative to the direction of working of the target material. GRA

N81-19283# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

MICROSTRUCTURAL DEVELOPMENT AND EVOLUTION DURING LIQUID PHASE SINTERING Final Report, 1 Oct. 1977 - 31 Dec. 1980

T. H. Courtney and J. K. Lee 25 Jan. 1981 26 p refs

(Contract DAAG29-79-C-0153; Grant DAAG29-77-G-0235)

(AD-A095094; ARO-14573.7-MS; FR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

Microstructural development and evolution during the liquid phase sintering process has been studied in terms of thermodynamic, kinetic and structural features. Solid phase contiguity primarily depends on solid volume fraction. Microstructural scale is adversely affected by contiguity since, under this condition, coarsening is accelerated by particle coalescence. It is found that contiguity can be expressed as a single function of particle volume fraction and microstructural scale can be adequately related to system parameters as well as particle volume fraction. GRA

N81-19284# New Jersey Inst. of Tech., Newark

MERCURY CADMIUM TELLURIDE SPUTTERING RESEARCH Annual Technical Report

Roy H. Cornely 1 Jun. 1980 18 p refs

(Grant AF-AFOSR-3249-77; AF Proj. 2306)

(AD-A094671; AFOSR-81-0106TR) Avail: NTIS HC A02/MF A01 CSCL 20/2

Improved as-deposited mobility values for RF triode sputtered thin films of (HG,Cd)Te, with 25 mole percent CdTe, were obtained by increasing the Hg vapor pressure and the temperature of the single crystal CdTe and Si substrates. Films on single crystal (111) oriented CdTe substrates had the highest as-deposited electron mobility, as determined by four point probe Hall-effect measurements; values of 2200 and 3720 cm squared per volt sec. with carrier concentrations of 5 and 2.8 times ten to the sixteenth per inverse cubic cm were obtained as 296 and 89 degree Kelvin, respectively. Using unoptimized procedures, it was shown that the n-type mobility could be appreciably increased. Films with complete (111) crystal orientation and composition of bulk crystals with the same mole percent of CdTe (x value) as that for the pressed powder targets (made from a mixture of HgTe and CdTe powders) were obtained for x values of 0.1, 0.18, 0.23, and 1.0. ESCA revealed that films with a mixture of (311) and (111) crystal orientations and submicron grain size were deficient in Hg. A nonlinear iV characteristic was measured for a sputtered heterojunction structure. GRA

N81-19285# Massachusetts Inst. of Tech., Cambridge.

SPECTROSCOPIC INVESTIGATIONS OF SMALL MOLECULE INTERACTIONS ON METAL OXIDE SURFACES Progress Report, 1 Sep. 1979 - 31 Oct. 1980

E. I. Solomon and F. Read McFeeley 31 Oct. 1980 11 p refs

(Contract DE-AC02-78ER-04988)

(DOE/ER-04988/2) Avail: NTIS HC A02/MF A01

Advances in surveying with angle integrated UV photoelectron spectroscopy (UPS) the interactions of general classes of chemically important small molecules with metal oxide surfaces are described, and the geometric and electronic structures of the small molecule-surface complexes observed by angle resolved UPS are elucidated. Progress is divided into several areas: (1) a detailed understanding of the unique active site structures associated with the interaction of CO with ZnO utilizing angle integrated and angle resolved photoemission spectroscopy; (2) initiating survey studies into new small molecule systems with emphasis on hydrogen and ethylene; and (3) successful construction and testing of a high resolution electron energy loss spectrometer. DOE

N81-19286# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

FUNDAMENTAL INVESTIGATIONS OF THE OXIDATION OF ALLOYS IN MULTICOMPONENT GASEOUS ENVIRONMENTS Annual Technical Progress Report, 1 Sep. 1979 - 31 Oct. 1980

G. J. Yurek 28 Oct. 1980 13 p refs

(Contract DE-AC02-79ER-10507)

(DOE/ER-10507/1) Avail: NTIS HC A02/MF A01

A gas mixing system and an apparatus for thermogravimetric analysis was developed for oxidation or sulfidation experiments in various mixtures of H2, H2O, H2S and Ar. The system is easily adapted to include C-bearing gases in the future. Chromium exhibits oxidation rate anisotropy, the slowest growing scales being found on the (110) planes of Cr. Oxidation of Cr single crystal disks having faces nearly parallel to (100) planes of Cr yields a very fine grained. Cr2O3 scale that contains pores and has a pitted surface. The density of the oxide is apparently less than the theoretical density of Cr2O3. The oxidation of Cr disks in the H2/H2O/H2S mixture at the same P/sub O2/ yielded a denser oxide with somewhat larger grains and less pitting at the surface. The oxide contains nearly spherical second phase precipitates, which may be metastable CrS. DOE

N81-19287# California Univ., Livermore. Lawrence Livermore Lab.

ELECTROLESS NICKEL: AN IMPORTANT COATING FOR DIAMOND TURNING APPLICATIONS

J. W. Dini 24 Sep. 1980 16 p refs Presented at the Electroless Nickel 2 Conf., Cincinnati, 17-18 Mar. 1981

(Contract W-7405-eng-48)

(UCRL-84976) Avail: NTIS HC A02/MF A01

Diamond turning is the use of a single-point diamond tool on a precision lathe under very precisely controlled machine and environmental conditions to fabricate finished components. With a machine presently available at LLNL a part accuracy between 0.05 and 1.0 (MU)m (2 and 40 millionths of an inch) is obtainable. Coatings offer significat advantages for diamond turning applications inasmuch as they can be applied to lightweight substrates such as aluminum or beryllium. One of the most used coatings for diamond turning applications is electroless nickel. Purpose of this paper is to document case histories of such applications and suggest areas for future work. GRA

N81-19288# Westinghouse Research and Development Center, Pittsburgh, Pa.

EMBRITTLEMENT OF CR-MO STEELS IN H2S PLUS H2O VAPOR ENVIRONMENT Quarterly Report, 15 May - 15 Aug. 1980

B. J. Shaw 28 Nov. 1980 19 p refs

(Contract DE-AC05-78ET-13513)

(DOE/ET-13513/T5; QR-8) Avail: NTIS HC A02/MF A01

Results from previous quarterly periods are summarized. A series of tests on 2 1/4 Cr-1 Mo and 1 1/4 Cr-1/2 Mo steels was conducted in 50 psig H2S saturated with water vapor. DOE

N81-19289# Rolls-Royce Ltd., Derby (England).

INVESTIGATIONS ON THE SUPER-PLASTIC BEHAVIOR OF OVER-EUTECTOID STEELS

Albert vondenSteinen 1980 15 p Transl. into ENGLISH of Thyssen Tech. Rept. (Germany), v. 5, no. 3, 1979

(PNR-90023; Trans-15113) Avail: NTIS HC A02/MF A01

The material requirements for superplastic behavior are reviewed. The processing of three steel samples, the test procedures and the test results are described. Samples (120 kg) were melted in an induction furnace, then remelted. The melt compositions are given. The subsequent forging, rolling and thermal processing are detailed. It is concluded that carbon steels can show superplastic behavior alter thermomechanical treatment. An increase in the carbon content improves the superplastic deformation behavior due to the increase of the cementite proportion in the microstructure. Author (ESA)

N81-19290# Trento Univ., Povo (Italy). Dept. of Physics.

ESCA INVESTIGATION ON 38NCD4 STEEL ION IMPLANTED WITH NITROGEN

I. Scotoni, C. Tosello, S. Sturlese (Centro Sperimentale Metallurgico), and S. Tosto (Fiat Research Center, Orbassano, Italy) 1979 6 p refs Submitted for publication

Avail: NTIS HC A02/MF A01

The surface layers of 38NCD4 steel samples, ion implanted with nitrogen, were investigated using electron spectroscopy for chemical analysis as an analytical technique for surface analysis. The experimental results show the chemical state of the implanted nitrogen, the nitrogen depth profiles as a function of the doses, and the effect of the implantation rate on the nitrogen depth profile. Author (ESA)

N81-19291# Electricity Council Research Centre, Capenhurst (England).

THE ELECTRODEPOSITION OF LEAD DIOXIDE ON TITANIUM

D. Gilroy and R. Stevens Apr. 1979 41 p refs

(ECRC/M1248; Job-108) Avail: NTIS HC A03/MF A01

Presently available lead dioxide anodes, suitable for applications in electrowinning and synthesis, suffer from shedding and other forms of breakdown. The results of nucleation experiments on titanium electrodes are interpreted in terms of idealized models of electrocrystallization. The effects of fluoride ion on the deposition parameters are particularly emphasized. Author (ESA)

N81-19292# Central Electricity Generating Board, Bristol (England). Scientific Services Dept.
APPLICATION OF A DIP COATING TO A COMPONENT OF MIXED-MATERIAL CONSTRUCTION, WHERE PACTS IN NONCORRIDIBLE MATERIAL MUST REMAIN UNCOATED
S. Sully Apr. 1980 4 p
(TDB-346; ISSN-0374-2784) Avail: NTIS HC A02/MF A01

An invention is described concerning the use of a dip-applied coating on a corrodible metal component for water-immersion applications, where the component incorporates non-corrodible parts which must remain uncoated. An example of such a component is a wedge-gate valve, of cast iron with stainless steel trim. Protection against the initiation of corrosive failure at coating discontinuities is provided. Author (ESA)

N81-19293# Rolls-Royce Ltd., Derby (England).
COATING + GRINDING = PROTECTION AGAINST WEAR
M. Bormann 1980 9 p Transl. into ENGLISH from Oberflaeche, 1979, v. 3 Partly in ENGLISH and GERMAN
(PNR-20039; Trans-15257) Avail: NTIS HC A02/MF A01

The evolution of the use of thermally sprayed coatings for imparting wear resistance to metal parts is presented. Alloys of chromium, nickel, boron and 13% tungsten are melted on with oxyacetylene torches. Small pieces are heated with a torch; larger ones are preheated in a furnace. Diamond wheels were used in place of boron nitride tools for finishing the sprayed pieces. Grinding wheels of metal coated synthetic diamonds in a synthetic resin binder are the most successful. Author (ESA)

N81-19294# Moleculon Research Corp., Cambridge, Mass.
POROPLASTIC BOUND LIQUID MEMBRANES FOR HYDROMETALLURGICAL PROCESSING Final Report
Arthur S. Obermayer, Larry D. Nichols, Marie Baroni Allen, Gerard Nahum, and Robert P. Caron 30 Sep. 1980 125 p refs
(Grant NSF DAR-78-19226)
(PB81-123267; NSF/RA-800230) Avail: NTIS HC A06/MF A01 CSCL 11F

Application of liquid ion-exchange membrane technology in hydrometallurgical systems to extract metals from ores and to remove harmful metallic species from industrial effluents is reported. Specific areas investigated were load and strip rates, metal selectivity, long-term membrane stability, membrane fabrication, and operational economics. Studies were conducted on tungsten extraction from Searles Lake brine, chromate removal and recovery from industrial plating rinse waters, and separation of nickel and cobalt ions from simulated lateritic leach solutions. Results demonstrate that isolation of tungsten requires a new ion exchange reagent ultrasensitive for this metal; extraction of chromate wastes requires effective, phase-stable solvents for quaternary ammonium salts exchangers; and commercial separation of cobalt from nickel may depend on improved poisoning-resistant and ammonia-impermeable reagents. The critical factor in all three cases only incidentally involves intrinsic capabilities of Poroplastic membranes. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-19295 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A MODEL FOR ABRASIVE POLYMER WEAR Ph.D. Thesis
John Henry Herold, II 1980 120 p
Avail: Univ. Microfilms Order No. 8101886

The abrasive mechanism of polymer wear is dominant in the startup, or breakin stage of polymer/steel sliding systems. This mechanism controls the polymer wear rate until the voids in the hard metal surface are filled, much like the filling observed with a file when used on soft metals. This regime of polymer wear is modeled on an event by event basis. The model utilizes a digitized profile of the metal surface, bulk polymer properties such as flow pressure and elongation at break, and a few system parameters such as load and slider geometry. The predictions of the model are compared with experimental data. The predicted wear rates are within a factor of 3 of the measured wear rates for polymers with glass transition temperatures above the interfacial temperature (rigid PVC and PCTFE). The validity of the model is shown to be related to the ductile or brittle behavior of the sliding polymer. Dissert. Abstr.

N81-19296* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITION AND METHOD FOR MAKING POLYIMIDE RESIN-REINFORCED FABRIC Patent
Tito T. Serafini and Peter Delvigs, inventors (to NASA) Issued 13 Jan. 1981 4 p Filed 6 Apr. 1979 Supersedes N79-24061 (17 - 15, p 1947)
(NASA-Case-LEW-12933-1; US-Patent-4,244,853; US-Patent-Appl-SN-027557; US-Patent-Class-260-33.4R; US-Patent-Class-427-221; US-Patent-Class-427-379; US-Patent-Class-528-353) Avail: US Patent and Trademark Office CSCL 11E

A composition for making polyimide resin reinforced fibers or fabric is discussed. The composition includes a polyfunctional ester, a polyfunctional amine, and an end capping agent. The composition is impregnated into fibers or fabric and heated to form prepreg material. The tack retention characteristics of this prepreg material are improved by incorporating into the composition a liquid olefinic material compatible with the other ingredients of the composition. The prepreg material is heated at a higher temperature to effect formation of the polyimide resin and the monomeric additive is incorporated in the polyimide polymer structure.
Official Gazette of the U.S. Patent and Trademark Office

N81-19297*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering.
DETERMINATION OF PHYSICAL AND CHEMICAL STATES OF LUBRICANTS IN CONCENTRATED CONTACTS, PART 2 Final Report
James L. Lauer Feb. 1981 89 p refs
(Grant NsG-3170)
(NASA-CR-3402) Avail: NTIS HC A05/MF A01 CSCL 11H

Infrared emission spectroscopy through a window in an operating bearing continued to provide most of the information gathered on the state of lubricants subjected to elastohydrodynamic (EHD) conditions. Other measurements were traction, scanning electron microscopy and elemental surface analysis X-rays. A very significant finding was the decomposition of a naphthenic oil lubricant in the presence of small concentrations of an organic chloride. Olefins and aromatics were formed in ever increasing amounts prior to total lubricant failure. An aromatic fluid also failed in the presence of chloride. A correlation was found between changes of the alignment of lubricant molecules evidence by infrared polarization and changes of traction under varying EHD stresses. Author

N81-19298# Indian Inst. of Tech., Bombay.
RADIATION AND PHOTO-CHEMICAL POLYMERIZATION AND PROPERTIES OF POLYMERS Summary Report, 5 Jan. 1976 - 30 Sep. 1980
D. D. Deshpande 1980 64 p refs
Avail: NTIS HC A04/MF A01

In an effort to obtain polymers without any contamination of catalyst fragements, both irradiation and photochemical initiation were investigated. Liquid crystals were used as a solvent to influence kinetics and improve tacicity. The effects of liquid crystals on rates and molecular weights are considered. The synthesis of special monomers having acetylenic linkages, photochemical copolymerization, and dielectrics are also discussed. Instruments used in the various experiments are also described.
A.R.H.

N81-19299*# Washington Univ., Seattle. College of Engineering.
INTERDISCIPLINARY RESEARCH ON THE NATURE AND

PROPERTIES OF CERAMIC MATERIALS
31 Dec. 1980 43 p refs
(Grant NGL-48-004-002)
(NASA-CR-164050; CMR-SASR-35) Avail: NTIS HC A03/MF A01 CSCL 07C

The advancement of material performance and design methodology as related to brittle materials was investigated. The processing and properties of ceramic materials as related to design requirements was also studied. E.D.K.

N81-19300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE CHEMISTRY AND FRICTION BEHAVIOR OF THE SILICON CARBIDE (0001) SURFACE AT TEMPERATURES TO 1500 DEG C
Kazuhisa Miyoshi and Donald H. Buckley Mar. 1981 14 p refs
(NASA-TP-1813; E-542) Avail: NTIS HC A02/MF A01 CSCL 11C

X-ray photoelectron and Auger electron spectroscopy analyses and friction studies were conducted with a silicon carbide (0001) surface in contact with iron at various temperatures to 1200 or 1500 C in a vacuum of 10 to the minus 8th power Pa. The results indicate that there is a significant temperature influence on both the surface chemistry and friction properties of silicon carbide. The principal contaminant of adsorbed amorphous carbon on the silicon carbide surface in the as received state is removed by simply heating to 400 C. Above 400 C, graphite and carbide type carbine are the primary species on the silicon carbide surface, in addition to silicon. The coefficients of friction of polycrystalline iron sliding against a single crystal silicon carbide (0001) surface were high at temperatures to 800 C. Similar coefficients of friction were obtained at room temperature after the silicon carbide was preheated at various temperatures up 800 C. When the friction experiments were conducted above 800 C or when the specimens were preheated to above 800 C, the coefficients of friction were dramatically lower. At 800 C the silicon and carbide type carbon are at a maximum intensity in the XPS spectra. With increasing temperature above 800 C, the concentration of the graphite increases rapidly on the surface, whereas those of the carbide type carbon and silicon decrease rapidly. Author

N81-19301*# National Aeronautics and Space Administration, Washington, D. C.
PLASMA-INITIATED POLYMERIZATION AND ITS APPLICATIONS
Y. Osada and E. Tsuchida Jan. 1981 19 p refs Transl. into ENGLISH from Purazuma to Kagaku (Japan), Apr. 1980 p 68-76 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Ibaraki Univ. and Waseda Univ.
(Contract NASw-3199)
(NASA-TM-75848) Avail: NTIS HC A02/MF A01 CSCL 07C

Plasma initiated polymerization is discussed. Topics include: polymerization of a vinyl monomer, solid phase polymerization, and inorganic ring compound polymers. E.D.K.

N81-19302# Dayton Univ., Ohio. Research Inst.
COMPATIBILITY OF RETICULATED FOAMS IN TYPICAL TURBINE FUELS WITH CURRENTLY APPROVED ADDITIVES Interim Technical Report, Mar. - Dec. 1979
Benjamin H. Wilt Sep. 1980 32 p refs
(Contract F33615-80-C-5002; AF Proj. 2421)
(AD-A094467; UDR-TR-80-76; AFWAL-TR-80-4135) Avail: NTIS HC A03/MF A01 CSCL 11/8

Reticulated polyester polyurethane foams have been successfully employed by the U.S. Air Force since the late 1960's in fuel tanks and dry bay areas of certain combat aircraft. Use of reticulated foams as fire and explosion retardants was initiated in 1965 when some Indianapolis 500 race cars were retrofitted with foam filled fuel tanks to improve the crash resistance of the tanks. As a result of tests conducted for the USAF to verify the fire and explosion suppressing capability of foams, a nominal 10 pores per inch foam was produced in which all membranes in the cell structure were eliminated by thermal reticulation. During 1970 to 1972, lighter weight polyester materials were developed. These foams, which were yellow and red in color, result in a weight reduction of approximately 25 percent. The new foams also exhibited improved hydrolytic stability over the Type I orange foam which was susceptible to the combined effects of temperature and humidity. Development of a polyether polyurethane foam was initiated in 1974. The resulting dark blue and light blue foams, designated as MIL-B-83054B, Types IV and V, respectively, were intended to provide hydrolytic stability estimated to be five to ten times greater than that of the polyester materials. GRA

N81-19303# RPJ Associates, Palos Verdes Peninsula, Calif.
REVIEW OF COMPLIANT COATING RESEARCH OF M. O. KRAMER Final Report
Roger P. Johnson 17 Oct. 1980 95 p
(Contract N00014-80-C-0955)
(AD-A094044; RPJA-TR-0955-001) Avail: NTIS HC A05/MF A01 CSCL 11/3

This technical report summarizes the 19 year history of experimental research on complaint coatings performed by Dr. Max O. Kramer. In addition to the drag reduction in the transitional flow region, the several test techniques, the various bodies of revolution, and the complaint coating designs are described in detail. GRA

N81-19304# Southwest Research Inst., San Antonio, Tex.
COMPRESSIVE STRENGTH AND DAMAGE MECHANISMS IN CERAMIC MATERIALS. 1: TEMPERATURE-STRAIN RATE DEPENDENCE OF COMPRESSIVE STRENGTH AND DAMAGE MECHANISM IN ALUMINUM OXIDE. 2: THRESHOLD MICROFRACTURE DURING ELASTIC PLASTIC INDENTATION OF CERAMICS Interim Technical Report, 1 Feb. - 31 Aug. 1980
James Lankford 10 Sep. 1980 57 p refs
(Contract N00014-75-C-0668)
(AD-A094324) Avail: NTIS HC A04/MF A01 CSCL 11/2

The results of compression tests of Al2O3 performed over a wide range in temperature and strain rate are interpreted in terms of dominant damage mechanisms. It is shown that compressive failure in Al2O3 is caused by one of three different mechanisms, each based on tensile (Mode I) growth of predominantly axial microcracks, and each characteristic of a specific temperature-strain rate regime. The concepts developed should be applicable to other strong ceramics. In addition, indentation experiments were carried out for a variety of ceramics. It is found that the threshold for microfracture during elastic-plastic indentation corresponds to radial, rather than subsurface median, crack formation. This is contrary to the fundamental assumption of existing models for threshold crack nucleation by sharp indenters or particles; the results indicate the need to modify the stress field calculations used in these models. GRA

N81-19305# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
EVALUATION OF POWDER COATINGS FOR APPLICATION TO AIRCRAFT COMPONENT PARTS Final Report
Everett Charves 4 Sep. 1980 66 p refs
(AD-A094724; NADC-79199-60) Avail: NTIS HC A04/MF A01 CSCL 11/3

Powder coatings, electrostatically applied to bare and primed aluminum and magnesium substrates, were evaluated as possible candidate coatings for aircraft and engine component parts. The powdered coatings were compared to the solvent based MIL-P-23377 primer and MIL-C-81773 topcoat system. When selected for specific applications, powdered coatings were superior to the solvent based coatings system in abrasion (wear) and chemical resistance. GRA

N81-19306# Akron Univ., Ohio. Inst. of Polymer Science.
EFFECT OF INTERFACIAL BONDING ON THE STRENGTH OF ADHESION OF ELASTOMERS 2: DISSIMILAR ADHERENDS
R. J. Chang and A. N. Gent 2 Feb. 1981 24 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A094750; TR-10) Avail: NTIS HC A02/MF A01 CSCL 11/1

Two elastomer layers, differing either in initial degree of crosslinking or in chemical reactivity, were bonded together by a free-radical crosslinking process. The elastomers employed were polybutadiene (BR) and an ethylene-propylene copolymer (EPR),

differing in the efficiency of crosslinking by dicumyl peroxide by a factor of about 20. When a fully-crosslinked sheet of either elastomer was pressed into contact with a partially-crosslinked sheet of the adhesion under threshold conditions was found to be qualitatively in accord with the predictions of a simple theoretical treatment for the degree of interlinking in terms of the corresponding homogeneous crosslinking reaction. Whereas the theory suggests that the effective degree of interlinking will be one-half of that generated in a homogeneous system, the experimental results were in accord with a figure of about 70 per cent. When a layer of one elastomer was bonded to a layer of the other in a similar way, the strength of adhesion was found to be relatively high when the initial fully-crosslinked layer was (BR) and relatively low when it was (EPR). GRA

N81-19307# Akron Univ., Ohio. Inst. of Polymer Science.
EFFECT OF INTERFACIAL BONDING ON THE STRENGTH OF ADHESION OF ELASTOMERS. 1. SELF-ADHESION
R. J. Chang and A. N. Gent 30 Jan. 1981 51 p refs Submitted for publication
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A094756; TR-9) Avail: NTIS HC A04/MF A01 CSCL 20/1

Two partially gelled (crosslinked) layers of elastomer were pressed into intimate contact and the gelation reaction was then taken to completion. By varying the extent of initial gelation, the degree of chemical interlinking was varied from zero, when two fully reacted sheets were pressed together, up to a level characteristic of the final density of molecular linking within each layer, when they were brought together before any reaction had occurred. The strength of adhesion between the layers was measured under threshold conditions, i.e., at low rates of peel, at high temperatures, and, in some instances, with the layers swollen with a compatible liquid. Linear relations were obtained between the threshold work of detachment per unit of interfacial area and the amount of chemical interlinking, deduced from the kinetics of molecular linking within each layer. At any degree of interlinking, ranging from zero to the fully interlinked state, the work of detachment was lower for networks composed of shorter molecular chains, in accordance with the Lake-Thomas theory of the threshold strength of elastomer networks. By extrapolation to the fully interlinked state, the strength of adhesion corresponding to cohesive rupture was inferred. These values agreed with measured tear strengths for polybutadiene gelled by a free radical process. For a sulfur crosslinking system and for both free radical and sulfur crosslinking of poly(ethylene-co-propylene), the threshold tear strength of the elastomer was found to be much higher than the extrapolated value from adhesion measurements. GRA

N81-19308# Dayton Univ., Ohio.
POLYMERIC MATERIAL TESTING PROCEDURES TO DETERMINE DAMPING PROPERTIES AND THE RESULTS OF SELECTED COMMERCIAL MATERIALS Technical Report, 15 Jan. 1976 - 31 Dec. 1979
Michael L. Drake and Gary E. Terborg Jul. 1980 236 p refs
(Contract F33615-76-C-51; AF Proj. 7351)
(AD-A094847; UDR-TR-80-40; AFWAL-TR-80-4093) Avail: NTIS HC A11/MF A01 CSCL 11/9

This report contains a detailed discussion of the methods and procedures used to determine the damping properties of commercially available polymeric materials. All the data from the testing is contained in the Appendices, which include the bare beam results, the coated beam results, and the temperature nomogram for each material tested. GRA

N81-19309# Dayton Univ., Ohio.
PORCELAIN ENAMEL MATERIAL TESTING PROCEDURES TO DETERMINE THE DAMPING PROPERTIES AND THE RESULTS OF SELECTED MATERIALS Technical Report, Jan. 1976 - Dec. 1979
David M. Hopkins and Michael L. Drake Wright-Patterson AFB, Ohio AFWAL Sep. 1980 561 p refs
(Contracts F33615-79-C-5137; F33615-79-C-5108)
(AD-A094666; UDR-TR-80-47) Avail: NTIS HC A24/MF A01 CSCL 11/2

This report contains a detailed discussion of methods and procedures used to define the vibration damping properties of high temperature (260 C to 780 C) damping materials. The work was done by the University of Dayton Research Institute, Dayton, Ohio in partial fulfillment of Air Force Contract Number F33615-76-C-5137 for the Materials Laboratory, Wright-Patterson Air Force Base, Ohio. The work described was conducted during the period January 1976 through December 1979. GRA

N81-19310# Battelle Columbus Labs., Ohio.
AN INVESTIGATION OF THE EFFECTS OF OXYGEN AND WATER VAPOR ON THE COMPRESSIVE FILM STRENGTH OF BOUNDARY FILMS ON IRON SUBSTRATES Final Report, 1 Jun. 1979 - 30 Nov. 1980
Edmund Drauglis and David K. Snediker 31 Dec. 1980 91 p refs
(Grant AF-AFOSR-3051-76; AF Proj. 2303)
(AD-A094739; AFOSR-81-0036TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Compressive film strengths were measured under controlled atmospheres by means of a unique film penetration apparatus developed at battelle. All experiments were performed on films formed from the diester DI-2-ethylhexyl sebacate containing various amounts of tricresyl phosphate. It was found that water is detrimental to the formation of good boundary films and that oxygen is necessary for the formation of good boundary films. Scanning electron microscopy showed that nonmetallic inclusions on armco Iron surfaces play an important role in initiating the formation of strong boundary films. Experiments with inclusion-free zone refined iron verified this result. Fourier transform infrared spectroscopy and X-ray photoelectron spectroscopy were also used to study the surface chemistry of the films. These techniques seem to indicate that the residual films are almost exclusively in organic phosphates. GRA

N81-19311# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
HIGH-HOT-HARDNESS GEAR/LUBRICANT EVALUATIONS Interim Report, Jan. 1978 - Sep. 1980
B. B. Baber Nov. 1980 27 p refs
(Contracts DAAK70-78-C-0001; DAAK70-80-C-0001; DA Proj. 1L7-62733-AH-20)
(AD-A095008; AFLRL-132) Avail: NTIS HC A03/MF A01 CSCL 13/9

A WADD gear machine was used to evaluate the gear load-carrying capacities of three high-hot-hardness gear materials, Cartech EX 00014, CBS 1000 M, and Vasco X-2 ESR, at 74 C and 218 C (165 F and 425 F). One MIL-L-23699C lubricant was used to evaluate all three gear materials at the two test temperature levels. Three additional military specification type turbine engine lubricants were included in the evaluation of the Vasco X-2 ESR gear material. An increase in gear load-carrying capacity, ranging from 10 to 35 percent, was obtained for the three high-hot-hardness gear materials when compared with equivalent 74 C (165 F) data using AMS 6260 steel gears. A candidate MIL-L-27502 lubricant provided the highest load-carrying capacity at 74 C (165 F) test conditions using the Vasco X-2 ESR test gears. It is shown that the load-carrying capacity of gears made from different materials do not necessarily have the same relative ranking when evaluated at two different temperature levels. GRA

N81-19312# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
LUBRICANTS FOR COMBATING EFFECTS OF HIGH-SULFUR FUEL Interim Report
Edwin A. Frame Jul. 1980 150 p refs
(Contracts DAAK70-80-C-0001; DAAK70-78-C-0001; DA Proj. 1L7-62733-AH-20)
(AD-A094900; AFLRL-127) Avail: NTIS HC A07/MF A01 CSCL 11/8

Six lubricants were evaluated for their effectiveness in controlling the deleterious effects of using high-sulfur diesel fuel. Two lubricants were identified which have potential to substantially reduce deleterious effects when operating on high-sulfur fuel. A supplemental oil additive used in preservative engine oils was evaluated in three different lubricants with high-sulfur fuel. GRA

N81-19313# Societe Nationale Industrielle Aerospatiale, Paris (France). Div. Systemes Balistiques et Spatiaux.

CONTRIBUTION TO THE EVOLUTION OF THE 'PEGOSITY' OF FIBROUS MATERIALS PRE-IMPREGNATED WITH EXPOXY RESIN [CONTRIBUTION A L'EVALUATION DE LA 'PEGOSITE' DES MATERIAUX FIBREUX PRE-IMPREGNES DE RESINES EPOXYDES]
Capdepuy and Popot 7 Nov. 1978 14 p In FRENCH Presented at Colloq. on Les Mater. a Matrices Polymers, France, 13-15 Nov. 1978
(SNIAS-801-430-102) Avail: NTIS HC A02/MF A01

An attempt was made to quantitatively define 'pegosity' because of its importance in determining the regularity and stability of the different layers deposited and its role in polymerization. Physicochemical parameters and their effects were studied, including vitreous transistion temperature of the resin, resudual polymerization energy, polydispersity (by gel chromatography), and electrical resistance. It is possible in this way to define an acceptable pegosity range, to more accurately determine treatments applicable to stored materials, and to provide a higher degree of quality control for industrial manufacturing.
Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-19314 Washington State Univ., Pullman.
VAPOR PHASE DETONATIONS IN LIGHT HYDROCARBONS Ph.D. Thesis
Robert Stewart Hixson 1980 154 p
Avail: Univ. Microfilms Order No. 8104134

Vapor phase explosions were studied under controlled conditions to see if detonation-like behavior could be initiated in a metastable material. Liquid propane was superheated past its normal boiling point and a low amplitude planar shock wave was introduced into the bulk of the material to attempt to initiate detonation. The results indicate that reaction behind the incident shock front is leading to acceleration of the front and the behavior of the pressure gauges seems to indicate the presence of two phase flow in the region behind the shock front. This behavior is consistent with the theory proposed. Dissert. Abstr.

N81-19315# Materials Research Labs., Melbourne (Australia).
DEVELOPMENT OF A GASLESS PYROTECHNIC CAP
John R. Bentley and Paul P. Elischer May 1980 28 p refs
(MRL-R-776; AR-002-160) Avail: NTIS HC A03/MF A01

A pyrotechnic percussion cap composition was developed and tested in M42 cup assemblies. The senstivity was comparable to M42 caps and preliminary tests indicated that the stability of the composition was satisfactory. The composition produced minimum gaseous by-products and gave at adequate output to ignite pyrotechnic delay unite reliably. The new composition overcomes the problem of cap ejection and venting due to the high pressures produced by traditional percussion cap compositions in hermetically sealed systems. Author

N81-19316*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
AN ASSESSMENT OF THE USE OF ANTIMISTING FUEL IN TURBOFAN ENGINES Final Report, Sep. 1979 - Nov. 1980
A. Fiorentino, R. DeSaro, and T. Franz Nov. 1980 146 p refs
(Contract NAS3-22045)
(NASA-CR-165258; PWA-5697-29) Avail: NTIS HC A07/MF A01 CSCL 21D

The effects of antimisting kerosene on the performance of the components from the fuel system and the combustor of a JT8D aircraft engine were evaluated. The problems associated with antimisting kerosene were identified and the extent of shearing or degradation required to allow the engine components to achieve satisfactory operation were determined. The performance of the combustor was assessed in a high pressure facility and in an altitude relight/cold ignition facility. The performance of the fuel pump and control system was evaluated in an open loop simulation. R.C.T.

N81-19317# Energy and Minerals Research Co., Exton, Pa.
EFFICIENT ULTRASONIC GRINDING: A NEW TECHNOLOGY FOR MICRON-SIZED COAL Quarterly Technical Progress Report, 16 Jun. - 15 Sep. 1980
W. B. Tarpley, Jr., P. L. Howard, and G. R. Moulder 1 Oct. 1980 19 p
(Contract DE-AC02-79ER-10466)
(DOE/ER-10466/T1; QTPR-4) Avail: NTIS HC A02/MF A01

The technical feasibility and economic promise of efficiently applying ultrasonic energy to the production of -10 micron coal fines is demonstrated. It is shown that such a system could overcome the inherent inefficiency and economic penalty of mechanical grinding, while producing better size uniformity in the product. An additional benefit associated with the mechanism of ultrasonic effect is the possibility of selective liberation of ash and pyrite inclusions. DOE

N81-19318# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
SOLID PROPELLANT COMBUSTION MECHANISM RESEARCH Final Report, 1 Apr. 1975 - Mar. 1980
Leonard H. Caveny, Martin Summerfield, Josette Bellan, and Moshe BenReuven Apr. 1980 21 p Sponsored in part by Army
(Contract N00014-75-C-0705)
(AD-A094618; MAE-1490) Avail: NTIS HC A02/MF A01 CSCL 21/9

The multi-task research conducted during the five years of the contract was aimed at furthering the scientific understanding of propellant combustion processes. The low pressure deflagrations of nitramines were interpreted by a physical model that accounts for the interactions among the condensed phase, surface, and near field flame zones. The model demonstrated the importance of considering both primary and secondary gas phase processes. Chamber flow interactions with propellants having extended flame zones elucidated contributions to erosive burning and sustained acoustic oscillations. The analysis points to the existence of an additional source of acoustic energy produced by couplings with heat addition from residual reactions in the chamber gases. Droplet burning was analyzed in terms of a reduced boundary condition at the surface and the quasi-steady heat feedback assumption. A formalism is offered for experimentally evaluating the boundary conditions for nonsteady conditions. Direct measurements of solid propellant acoustic admittance were made using laser doppler velocimetry coupled with an optical technique for tracking the burning surface. This report contains abstracts of the detailed publications on each topic. GRA

N81-19319# Hercules, Inc., Radford, Va.
TNT PURIFICATION STUDIES, TASK 1. COMPARATIVE COST STUDY OF PURIFICATION METHODS Final Report
J. R. Spencer and E. E. Gilbert Dover, N. J. ARRADCOM Dec. 1980 62 p refs
(Contract DAAA09-77-C-4007)
(AD-A094755; AD-E400529; ARLCD-CR-80045) Avail: NTIS HC A04/MF A01 CSCL 19/1

This project was initiated to provide cost data for three most promising methods of purifying TNT. The methods considered include nitric acid crystallization (followed by isomer separation via the Brodie Process), magnesium sulfite (followed by recovery of MgO for recycle) and Sellite (followed by chemical recovery via the Sonoco Process. GRA

N81-19320# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF A HAZARD CLASSIFICATION PROCEDURE FOR INPROCESS PROPELLANT AND EXPLOSIVE MATERIALS Final Report
Hyla S. Napadensky, Ronald Pape, Richard Rindner, and Daniel Sathriana Dover, Del. ARRADCOM Nov. 1980 275 p refs
(Contract DAAK10-78-C-0029)
(AD-A094741; AD-E400513; IITRI-J6432; ARLCD-SP-80004)
Avail: NTIS HC A12/MF A01 CSCL 19/1

The DOD Explosives Safety Board files, hazards analyses, and existing test methods were reviewed. These were used as

the basis for developing a preliminary structure for the hazards classification procedure. The most promising test for incorporation into the procedure was experimental evaluations. Evaluations were completed for local impact, rubbing friction, local thermal, regional thermal, electrostatic discharge, critical diameter, critical layer thickness, tube transition, layer transition, mass explosion, mass fire and firespread tests. The results of these tests served as the basis of the final hazards classification procecure. GRA

N81-19321# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

PRODUCTION AND ASSESSMENT OF DAMAGED HIGH ENERGY PROPELLANT SAMPLES

Wayne L. Elban 8 May 1980 43 p refs
(AD-A094720; NSWC/TR-79-259) Avail: NTIS HC A03/MF A01 CSCL 21/9

This work was undertaken to subject a variety of high energy propellants to different stress fields and to assess the microstructural changes that occur. Low strain rate mechanical deformation in compression and low temperature thermal stressing were used to damage samples. These materials were tested nondestructively using ultrasonics in which longitudinal sound velocity measurements were made. Microscopic examination was performed on microtomed sections of damaged and undamaged propellant, as well as on fracture surfaces when appropriate. Propellant recovered from a low amplitude shock sensitivity experiment, an aquarium shot, was also evaluated for comparison purposes. In general, propellant samples that had been compressed at low strain rate did not undergo extensive damage. Crack densities were very low, and dewetting was the observed damage mechanism. Propellant samples exposed to liquid nitrogen exhibited numerous brittle fractures and little, if any, dewetting. Based on sound velocity measurements, the deformation was localized, leaving a large volume of material undisturbed. Propellant recovered from the aquarium experiment was damaged most extensively of all the material examined in this work. The crack number density and the area of crack surfaces/unit volume of propellant were highest. Sound velocity measurements indicate that dewetting did not occur in sizable portions of the material and that again the deformation was localized. GRA

N81-19322# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.

PHOTOFLASH COMPOSITIONS DESENSITIZED BY COATANTS

S. Dallman, B. Werbel, and F. R. Taylor Dec. 1980 30 p refs
(AD-A094754; AD-E400522; ARLCD-TR-80043) Avail: NTIS HC A03/MF A01 CSCL 19/1

A process for blending photoflash powder was investigated in which the powder was coated with material for the purpose of decreasing the hazard. Various coatant candidates were applied by both coacervation and contact methods and the resulting formulations characterized with respect to physico-chemical, sensitivity, stability, and performance properties. The method finally selected was contact coating from a wet medium employing an electrically conducting carbon black as coatant. During the program there was a scale-up from laboratory bench quantities to a 5 kg batch. For the larger batches a counter current mix muller was employed. The method is safer than the non-proprietary standard methods previously used, since the material is wet or damp throughout the blending process. Furthermore, the coating, by its ability to leak off voltage, reduces the electrostatic hazards during the blending and further processing of the powder. The product obtained is stable and equals the performance of the uncoated formulations. GRA

N81-19323# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

EVALUATION OF FUEL CHARACTER EFFECTS J79 SMOKELESS COMBUSTOR Final Technical Report, 1 Jul. 1979 - Jun. 1980

C. C. Gleason, T. L. Oller, M. W. Shayeson, and M. J. Kenworthy Nov. 1980 194 p refs
(Contract F33615-79-C-2033; AF Proj. 3048)
(AD-A095057; R80AEG618; AFWAL-TR-80-2092; AFESC/ESL-TR-80-46) Avail: NTIS HC A09/MF A01 CSCL 21/4

Results of a program to determine the effects of broad variations in fuel properties on the performance, emissions, and durability of the J79-17C turbojet engine combustion system are presented. Thirteen different fuels were tested, covering a range of hydrogen contents, aromatic types, boiling ranges, and viscosities. At high power operating conditions, fuel hydrogen content was found to be a very significant fuel property with respect to linear temperature, flame radiation, smoke, and NOx emission levels. At idle and cruise operating conditions, CO and HC emission levels were found to be dependent on both fuel hydrogen content and relative spray droplet size. At cold day ground start conditions lightoff correlated with the relative fuel droplet size. Altitude relight limits at low flight Mach numbers were fuel dependent and also correlated with the relative fuel droplet size. Combustor liner life analyses, based on the test data, yielded relative life predictions of 1.00, 0.93, 0.83, and 0.73 for fuel hydrogen contents of 14.5, 14.0, 13.0, and 12.0 percent, respectively. High temperature cyclic fuel nozzle fouling tests revealed significant effects of fuel quality and operating temperature on nozzle life. The results correlated with laboratory thermal stability ratings of the fuels. GRA

N81-19324# Davy Powergas, Inc., Houston, Tex.

LIGNITE-TO-METHANOL: AN ENGINEERING EVALUATION OF WINKLER GASIFICATION AND ICI METHANOL SYNTHESIS ROUTE Final Report

S. Goyen, E. Baily, J. Mawer, and R. Arai Oct. 1980 150 p
Sponsored by Electric Power Research Inst.
(EPRI Proj. 832-3)
(EPRI-AP-1592) Avail: NTIS HC A07/MF A01

A preliminary conceptual design, capital requirements, and product cost for a lignite to methanol plant. The lignite to methanol is designed to produce 15,000 TPD of fuel grade methanol. The complex is designed to be self sufficient with respect to all utility services, offsites, and other support facilities, including power generation. The results are summarized as follows: (1) ions per day (TPD) of lignite feedstock and fuel (as received) was 47,770; (2) TPD of fuel grade methanol product was 15,000; (3) thermal efficiency, % (HHV) was 47.4; (4) plant investment expressed in terms of first quarter of 1980 was ($ million) 1545; and (5) applying the economic premises used for fuel conversion plant utility type financing, the calculated levelized and first year product costs are inclined. DOE

N81-19325# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

CRITICAL STUDIES IN THE RAPID PYROLYSIS AND HYDROPYROLYSIS OF COAL Project Report, 1 Jul. 1979 - 31 Mar. 1981

Jack E. Howard, Ted M. Bush, Frank Cariello, Eva Ciesielczyk, Howard Franklin, Michael A. Serio, Robert M. Steinberg, and William A. Peters Jun. 1980 63 p refs
(Contract DE-AT01-76-ET-10693; EX-76-A-01-2295)
(FE-MIT-2295T26-10) Avail: NTIS HC A04/MF A01

The product slate obtained from hydropyrolysis of coal at 1000 C and a hydrogen pressure of only 1 atm is quite different from that produced by pyrolysis. Switching the main gas from helium to hydrogen results in many gas product shifts, including ethylene to ethane and CO2 to CO. CO becomes a major gas product as methane yields are increased considerably. Comparison of the appearance of the two tar products also indicates major compositional differences. Hydropyrolysis tars were light in color and almost completely soluble in methylene chloride, while pyrolysis tars were vary dark in color and only partially soluble. Pyrolysis and hydropyrolysis experiments were also run with demineralized coal and with various added minerals. DOE

N81-19326# Institute of Gas Technology, Chicago, Ill.

BIOGASIFICATION OF PRETREATED REED SEDGE PEAT

S. Ghosh 1980 20 p refs Presented at the 6th Intern. Peat Congr., Duluth, Minn., 17-23 Aug. 1980
(CONF-800876-1) Avail: NTIS HC A02/MF A01

The anaerobic digestion characteristics of acid treated Reed Sedge peat under mesophilic and thermophilic conditions are described. The effect of acid treatment on methane production from peat is discussed. Types of nutrients used include sewage sludge. Chemical characteristics indicate that anaerobic digestion of peat could be deficient in phosphorus, sodium, potassium,

and magnesium. Acid hydrolysis increased gas production and volatile acids. Thermophilic conditions resulted in higher gas and methane yields. Addition of large quantitites of sewage sludge greatly improved methane yield. Diluted digested slurries can be dewatered by vacuum filtration and mechanical pressing into cakes (34% wt solids). DOE

N81-19327# Institute of Gas Technology, Chicago, Ill.
PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK Annual Report, May 1978 - 30 Apr. 1979
Sep. 1980 664 p refs
(FE-2286-48) Avail: NTIS HC A99/MF A01

Two correlations of vapor-liquid equilibria in the NH3-H2S-H2O system were tested on experimental data for the system. Correlations of the salting out coefficients of ammonia, carbon dioxide, and hydrogen sulfide at 25 C were developed. The basic, physical, and thermodynamic properties of xylenols and decalins are given. Enthalpies of distillate fractions of various syncrudes are presented and compared with correlations. The combustion characteristics of solvent refined coal are summarized. A report on the viscosity of slag is presented. Application of a formula for calculating the heating value of coal to coal chars to new data indicated larger standard deviations than those for the original data bank. The general fundamental design information on a fixed (moving) bed coal gasifier is reviewed and the possibility of using a computer model to generate design information is investigated. The problem of carbon deposition in methanators is reviewed. In gas solids transport, correlations on pressure drop in dilute phase pneumatic conveyor and vertical dense phase transport in lift line are evaluated. Processes for sulfur recovery in wastewater treatment and hydrocarbon incineration are described. DOE

N81-19328# Chicago Univ., Ill.
COAL TRANSFORMATION CHEMISTRY Quarterly Progress Report, 1 Mar. - 31 May 1980
L. M. Stock 1980 20 p refs
(Contracts DE-AC22-80PC-30088; DE-AS02-77ET-10487)
(DOE/PC-30088/1; QPR-1) Avail: NTIS HC A02/MF A01

The development of a procedure for the alkylation of Illinois No. 6 coal in liquid ammonia is discussed. Work on the chemistry of the liquefaction reaction indicates that phenolic compounds participate in free radical reactions in hydrogen donor solvents. Phenolic compounds and benzoic acid derivatives do not function as acid catalysts in their reactions with tetralin and other representative compounds. In addition, the reaction of styrene with tetralin at 400 C is shown to be a complex process involving rather deepseated chemical transformations. DOE

N81-19329# Los Alamos Scientific Lab., N. Mex. Energy Programs Office.
USE OF NON-PETROLEUM FUELS TO REDUCE MILITARY ENERGY VULNERABILITIES: SELF-SUFFICIENT BASES AND NEW WEAPON PROPULSION SYSTEMS
David A. Freiwald 1980 19 p refs Presented at the 46th Mil. Operations Res. Soc. Meeting, Newport, R.I., 2-4 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3445; CONF-801239-1) Avail: NTIS HC A02/MF A01

An approach is outlined which is directed towards moving the U.S. military in the direction of energy self-sufficiency without having to rely on frequent deliveries of military fuels from off-base sources. The various pathways and options of this approach are considered. It is shown that the nuclear and hydrogen pathway is most likely to yield the best possibility for ultimate self-sufficiency. R.C.T.

N81-19330# Los Alamos Scientific Lab., N. Mex.
STORAGE STABILITY OF X-0298: A RUBBER-BONDED HMX-BASED EXPLOSIVE
E. D. Loughran Dec. 1980 7 p refs
(Contract W-7405-eng-36)
(LA-8551-MS) Avail: NTIS HC A02/MF A01

The storage stability at elevated temperatures of X-0298, a rubber-bonded HMX composition, was determined. After 34 months in sealed containers at 40, 50, and 60 C, physical properties of tensile specimens exhibited no significant degradation. Gas evolution rates from small cylinders of X-0298 stored in air-filled ampoules at 60, 75, and 90 C were 30, 80, and 1000 cm (3)/ kg/yr. Compared with other energetic explosives, X-298 is exceptionally stable when stored at temperatures below 60 C. DOE

N81-19331# Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
ETHANOL: A BRIEF ECONOMIC EVALUATION
Sep. 1980 12 p
(Contract DE-FG06-79ET-27256)
(DOE/ET-27256/T7) Avail: NTIS HC A02/MF A01

A 10 MW geothermal flash steam power plant is described. A 10 million gallon per year ethanol plant is considered. The initial feed to the plant would be corn, with sugar beets as a possible alternate feed. The ultimate plan is to use waste products and biomass feed stocks. Geothermal water would provide the necessary process heat for the plant. The following conclusions are based on an ethanol plant that produces 10 million gallons of ethanol per year. Over a 20 year period, the plant using a corn feed stock would generate a rate of return of +12% present on a total equility capital investment of $33,000,00. Over a 15 year period, the plant using a corn feed stock is probably not economically feasible since it would have a rate of return less than 12 percent or a total equity capital investment of $33,000,000. A corn feed stock plant operates at a loss for the first seven years if 95 percent of the $33,000,000 cost is debt financed. The plant is economically feasible only if offsetting energy income from other profitable operation permits taking advantage of investment tax credits and depletion allowances that are available. If this is true, the project is highly feasible, paying back twice the 5 percent equity capital in the first year. DOE

N81-19332# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
ENVIRONMETRICS OF SYNFUELS. 2: A COMPUTER-BASED CODING SCHEME FOR COAL-CONVERSION RESEARCH DATA
R. H. Strand, M. P. Farrell (Union Carbide Corp.), T. K. Birchfield, C. W. Gudmundson (Union Carbide Corp.), M. E. Vansuch (Union Carbide Corp.), and H. N. Polovino (Union Carbide Corp.) Jan. 1981 26 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7525; Pub-1602) Avail: NTIS HC A03/MF A01

The need to reduce the complexity of data encoding and error rates in studies using multiple data bases composed of hierarchial file structures is addressed. A coding scheme to represent long alphanumeric values, the efficiency of such a scheme, and error rate reduction are discussed. It is found that codes without embedded information (nonsense codes) circumvent the problems associated with smart codes. In addition, experience with several large environmental data bases indicates that coding errors are less frequent using nonsense codes than using smart codes. Since no information is contained in the nonsense code and classification levels are not correlated, there is no tendency for a code recorder to assume that two apparently associated values should code with approximately the same numeric code, when in fact the values are unrelated. The use of the FORMAT procedure in the Statistical Analysis System and of the nonsense code approach using variable labelling is presented. The increased storage efficiencies for numerical codes versus long alphanumeric strings are discussed. DOE

N81-19333# CH2M/Hill, Boise, Idaho.
UTILIZATION OF GEOTHERMAL ENERGY FOR METHANE PRODUCTION FOR J. A. ALBERTSOND LAND AND CATTLE COMPANY Final Report
Jul. 1980 201 p refs
(Contract DE-AC51-79ET-27230)
(DOE/ET-27230/T2) Avail: NTIS HC A10/MF A01

The feasibility of an integrated system to utilize a geothermal resource for a bioconversion plant was studied. This integrated facility would use the manure from approximately 30,000 head of feedlot cattle as a feedstock for an anaerobic digestion plant. The findings on engineering design, geological assessment,

environmental, economic, and institutional requirements of the proposed project are summarized. DOE

N81-19334# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF SWEET SORGHUM AS AN ENERGY CROP. VOLUME 3: INTEGRATION CONCEPTS
D. A. Scantland, W. E. Riddle, T. A. McClure, P. G. Woodford, E. J. Honton, and E. S. Lipinsky 12 Dec. 1980 147 p refs
(Contract W-7405-eng-92)
(BMI-2054-Vol-3) Avail: NTIS HC A07/MF A01

For the past 3 years, Batelle's Columbus Division and several coinvestigators conducted interregional investigations related to biomass and sugar production for conversion to alcohol and other fuels. These investigations emphasized primarily the production of sweet sorghum and sugar cane due to their ability to produce high biomass and readily fermentable sugars' yields which allow a highly favorable energy balance when converted to ethanol. The objectives of the research include the following: (1) to conduct a prefeasibility analysis of the potential for integrating sugarcane and sugar beet production/processing with sweet sorghum; and (2) to formulate an analytical approach to estimate the economic impact of growing sweet sorghum as an energy crop upon the US agricultural system. This volume is comprised of two separate investigations pertaining to potential integration of sweet sorghum into US agriculture. DOE

N81-19335# Conoco Coal Development Co., Library, Pa.
ZINC HALIDE HYDROCRACKING PROCESS FOR DISTILLATE FUELS FROM COAL. VOLUME 1: SUMMARY AND CONTINUOUS BENCH STUDIES Final Report, Jan. 1975 - Nov. 1979
R. T. Struck, C. W. Zielke, M. Pell, J. T. Maskew, F. Sim, W. A. Rosenhoover, and W. E. Clark 1 Dec. 1980 337 p refs
(Contracts DE-AC01-76ET-10489; EX-76-C-01-1743)
(FE-1743-80-Vol-1) Avail: NTIS HC A15/MF A01

The development of the Conoco process for liquefaction of coal using a pool of molten zinc chloride as catalyst is discussed. Continuous bench-scale hydrocracking and regeneration units (1 kg/h) showed that both bituminous and subbituminous coals are operable and convert to high yields of gasoline and other distillates with unusually low nitrogen and sulfur contents. A data base and a rate model were developed for Rosebud Seam subbituminous coal allowing conversions and product distributions to be predicted as functions of temperature, pressure, and residence time. Regeneration of the used catalyst was demonstrated giving 97(+)% removal of C, N, O, S and ash. A secondary zinc recovery step was developed increasing the recovery to 99.7%. DOE

N81-19336# Mueller Associates, Inc., Baltimore, Md.
ALTERNATIVE FUELS UTILIZATION AND THE AUTOMOTIVE EMISSION CERTIFICATION PROCESS
Washington DOE Mar. 1980 43 p refs
(Contract DE-AC05-79CS-56051)
(DOE/CS-56051/T1) Avail: NTIS HC A03/MF A01

The Clean Air Act of 1977 requires that commercially offered automotive fuels and fuel additives be substantially similar to fuels used in certifying model year 1975 and later vehicles. Procedures for certifying that vehicles perform with emissions that meet the Clean Air Act specifications and the impact of this emissions certification process on the use of alternative fuels, such as alcohols, alcohol-gasoline blends and synthetic fuels in highway vehicles is discussed. DOE

N81-19337# PRC Energy Analysis Co., McLean, Va.
BIOMASS ENERGY SYSTEMS PROGRAM SUMMARY. INFORMATION CURRENT AS OF SEPTEMBER 30, 1979
Oct. 1980 189 p
(Contract DE-AC01-77ET-21059)
(DOE/CS-21059/01) Avail: NTIS HC A09/MF A01

This program summary describes each of the DOE's Biomass Energy System's projects funded or in existence during fiscal year 1979 and reflects their status as of September 30, 1979. The summary provides an overview of the ongoing research, development, and demonstration efforts of the preceding fiscal year as well. DOE

N81-19338# Los Alamos Scientific Lab., N. Mex.
INVESTIGATING EXPLOSIVE AND MATERIAL PROPERTIES BY USE OF THE PLATE DENT TEST
George H. Pimbley, Allen L. Bowman, Wayne P. Fox, James D. Karshner, Charles L. Mader, and Manuel J. Urizar Nov. 1980 23 p refs
(Contract W-7405-eng-36)
(LA-8591-MS) Avail: NTIS HC A02/MF A01

A method is described whereby the plate dent technique is used to estimate the yield strength of a material. Yield strengths of steel, aluminum, beryllium, lead, and Tuballoy are examined. DOE

N81-19339# Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Technische Thermodynamik.
DEVELOPMENT OF MULTISTEP PROCESSES FOR THERMOCHEMICAL HYDROGEN PRODUCTION USING NUCLEAR HEAT. A SUMMARY Final Report
Helmut Wolfgang Cremer, Peter Schuster, Gerhard Steinborn, G. Wozny, and G. Wuester Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-121; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12,85

A thermochemical water splitting technique, using heat at temperatures lower than 1000 C, is described. Several chemical reactions based on multistep processes of the iron/chlorine family are involved. The additional chemical components are recycled; the necessary energy is supplied by a high temperature nuclear reactor. Many thermochemical cycles are considered among which the more favorable are selected by means of thermodynamic, chemical and engineering criteria, experimental studies of the individual chemical reactions and of sequences of reactions, and by means of balance and optimization calculations underlying process flow schemes. The selected Fe/Cl system is discussed comprehensively, emphasizing the self regenerating nature of each reaction subsystem and the overall integration of the separation processes. Author (ESA)

N81-19340# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST, A JOURNAL ON BIOMASS UTILIZATION, VOLUME 2, NUMBER 3, JULY 1980 Quarterly Report
Harry Sobel, ed. Jul. 1980 63 p refs
(Grant NSF PFR-77-12500)
(PB81-123952; NSF/RA-800222-VOL-2) Avail: NTIS HC A04/MF A01 CSCL 21D

Grant awards listed in this issue include the following: lignocellulose-transforming microorganisms; pyrolytic conversion of lignocellulosic materials; lipids from microalgae; rubber analysis and guayule seed selection; regulation of rubber formation in guayule plants; chemical stimulation and breeding improvement of rubber yield in guayule; hydrocarbon-producing plants as potential multi-use crops; and an animal waste management system for the 1980's. GRA

N81-19341# General Atomic Co., San Diego, Calif.
THERMOCHEMICAL WATER SPLITTING FOR HYDROGEN PRODUCTION Annual Report, 1 Jan. - 31 Dec. 1979
G. E. Besenbruch, D. R. OKeefe, and J. H. Norman Feb. 1980 117 p refs
(GSRI Proj. 2252)
(PB81-123473; GRI-79/0057) Avail: NTIS HC A06/MF A01 CSCL 21D

The sulfur-iodine process was investigated. The effort has centered principally on six areas: (1) the thermodynamics of the main solution reaction (2H2O + SO2 + z12 - 3Hx + H2SO4) to develop a model of the system; (2) the H2SO4 boost reaction to increase the yield of sulfuric acid from the main reaction; (3) support of the flow sheet effort to incorporate chemistry process improvements into the process; (4) decomposition of hydrogen iodide in the liquid phase; (5) vapor pressures and solubilities associated with the lower phase process mixtures and other HI/I-containing process liquids; and (6) the gas-liquid phase relationships resulting from treatment of the lower phase. The results achieved in these areas are described in detail. GRA

N81-19342# TRW, Inc., McLean, Va. Energy Systems Planning Div.
ENERGY BALANCES IN THE PRODUCTION AND END-USE OF ALCOHOLS DERIVED FROM BIOMASS
Oct. 1980 141 p refs Sponsored in part by DOE, Washington, D.C.
(PB81-125585; NAFC-80-10) Avail: NTIS HC A07/MF A01 CSCL 21D

The utility of converting one form of energy into another more valuable form is considered. Net fuel gain is defined, for the purpose of the savings in fuels (with special attention to premium fuel) obtained by substituting biomass derived ethanol (grain, woody-biomass, MSW, etc.), for a given end-use of a premium fuel. Six cases, encompassing three feedstocks, five process fuels, and three process variations, are examined. For each case, two end-uses (automotive fuel use and replacement of petrochemical feedstocks) are scrutinized. Energy requirements calculated for the six process cycles accounted for fuels used in all stages of alcohol production, from agriculture through distribution of products to the end-user. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-19343* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAFETY SHIELD FOR VACUUM/PRESSURE CHAMBER VIEWING PORT Patent
Richard A. Shimansky and Rodney S. Spencer, inventors (to NASA) Issued 20 Jan. 1981 4 p Filed 29 Jun. 1979 Supersedes N79-32207 (17 - 23, p 3045)
(NASA-Case-GSC-12513-1; US-Patent-4,254,566; US-Patent-Appl-SN-053571; US-Patent-Class-109-49.5; US-Patent-Class-49-171; US-Patent-Class-109-58.5; US-Patent-Class-220-82R; US-Patent-Class-220-89A) Avail: US Patent and Trademark Office CSCL 13L

Observers are protected from flying debris resulting from a failure of a vacuum or pressure chamber viewing port following an implosion or explosion by an optically clear shatter resistant safety shield which spaced apart from the viewing port on the outer surface of the chamber.
Official Gazette of the U.S. Patent and Trademark Office

N81-19344*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A CYCLING JOULE THOMSON REFRIGERATOR Patent Application
Emanuel Tward, inventor (to NASA) (JPL) Filed 28 Jan. 1981 18 p
(Contract NAS7-100)
(NASA-Case-NPO-15251-1; NASA-Case-NPO-15254-1; US-Patent-Appl-SN-229239) Avail: NTIS HC A02/MF A01 CSCL 13A

A symmetrical adsorption pump/compressor system having a pair of mirror image legs and a Joule-Thomson expander, or valve, interposed between the legs thereof for providing a new, efficient refrigeration cycle is described. The system further includes a plurality of gas operational heat switches adapted selectively to transfer thereto heat from a thermal load and to transfer or discharge heat therefrom through a heat projector, such as a radiator or the like. The heat switches comprise gas pressurizable chambers adapted for alternate pressurization in response to adsorption and desorption of a pressurizing gas confined therein. Author

N81-19345*# IIT Research Inst., Chicago, Ill.
MANUFACTURING PROCESS APPLICATIONS TEAM (MATEAM) Quarterly Status Report, 1 Aug. - 31 Oct. 1978
4 Dec. 1978 25 p
(Contract NAS8-32229)
(NASA-CR-150881; QSR-3; H6056) Avail: NTIS HC A02/MF A01 CSCL 20L

The activities of the Manufacturing Process Applications Team concerning the promotion of joint Industry/Federal Agency/NASA funded research and technology operating plan (RTOP) programs are reported. Direct transfers occurred in cutting tools, laser wire stripping, soldering, and portable X-ray unit technology. TROP program funding approval was obtained for the further development of the cutting tool Sialon and development of an automated nondestructive fracture toughness testing system. M.G.

N81-19346*# National Aeronautics and Space Administration, Washington, D. C.
PROCESS FOR PURIFICATION OF SOLIDS
H. Herzer, H. J. Rath, and D. Schmidt Feb. 1981 13 p refs Transl. into ENGLISH from West German Patent (Appl. no. 2722784, 30 Nov. 1978) p 1-10 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76551) Avail: NTIS HC A02/MF A01 CSCL 13H

A process for purifying solids, especially silicon, by melting and subsequent resolidification, is described. Silicon used in solar cell manufacturing is processed more efficiently and cost effectively. S.F.

N81-19347# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
LOADED SURFACES IN CONSTRUCTION TECHNIQUES [FLAECHENTRAGWERKE IM KONSTRUKTIVEM INGENIEURBAU]
J. H. Argyris, O. Hilpert, U. Hindenlang, G. A. Malejannakis, and E. Schelkle 1979 134 p refs In GERMAN
(Contract DFG-Ar-44/36)
(ISD-263; ISSN-0170-6071) Avail: NTIS HC A07/MF A01

Natural surface geometry was developed to investigate the geometric and physical mechanisms on the surface of a double curved molded structure. A symmetric formation of the surface specific size and kinetic relationship to the deformation of the surface was obtained. Nonlinear scaling problems were applied to further develop a displacement element which specifies nonlinear calculations. The Newton-Raphson method was used as a standard procedure. A new procedure, the characteristic value analysis, was developed to solve singularity problems.
Transl. by E.A.K.

N81-19348# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
SOME FUNCTIONAL METRICS IN ALGEBRAIC AND COMBINATORIAL CODING Ph.D. Thesis - Pierre et Marie Curie Univ., Paris [QUELQUES FONCTIONNELLES METRIQUES EN CODAGE ALGEBRIQUE ET COMBINATOIRE]
Gerard Choen Jun. 1980 118 p refs Partly in FRENCH and ENGLISH
(ENST-E-80006) Avail: NTIS HC A06/MF A01

Three approaches to coding problems can be systematically distinguished: probabilistic (essentially existential), algebraic, and combinatorial. This last approach searches for optimal configurations and relegates to the second order, the problems of complexity related to decoding. Enumeration, graphs, designs, and the extreme theory of groups are used. The optimization of a functional metric was used with the combinatorial approach in order to define the space considered and the distance. The codes then become particular groups of the metric space, which is defined by parameters such as length, number of words, and capacity for correction. Some of these parameters are imposed. A.R.H.

N81-19349# Naval Ocean Systems Center, San Diego, Calif.
REMOTE UNMANNED WORK SYSTEM VEHICLE TETHER CABLE TERMINATION AND POTTING PROCEDURES Final Report, 1978 - 1980
Robert S. Stark Dec. 1980 55 p refs
(AD-A094725; NOSC/TD-394) Avail: NTIS HC A04/MF A01 CSCL 13/10

The procedures for potting and terminating the strength and electrical portions of the tether cable of the Remote Unmanned Work System (RUWS) are described. Also included are lists of tools and materials to be used in the process. GRA

N81-19350# Aeronautical Research Labs., Melbourne (Australia).
THE SHAPE OF A CABLE USED FOR TOWING A PITOT-

STATIC PROBE FROM A HELICOPTER
N. E. Gilbert Jun. 1980 23 p refs
(AD-A095017; ARL/Aero-Note-397) Avail: NTIS HC A02/MF A01 CSCL 01/3

The shape of a cable used to tow a pitot-static probe from a helicopter is estimated for airspeeds up to 120 kn. These estimates show the probe to be well outside the influence of the rotor wake. Experimental results obtained from photographs taken from a chase helicopter are used to resolve an uncertainty in cable drag coefficient and comparisons are made with the theoretical predictions of overall shape. The effect of the assumption of a weightless cable and of reduced probe drag are also shown. GRA

N81-19351# United States Metric Board, Arlington, Va.
FIVE YEARS AFTER THE METRIC CONVERSION ACT, WHERE DO WE STAND? SURVEY OF LARGE US MANUFACTURING AND MINING FIRMS (THE FORTUNE MAGAZINE 1000)
Dec. 1980 14 p
(AD-A095116) Avail: NTIS HC A02/MF A01 CSCL 05/1

A mail survey of randomly chosen 202 of the 1000 largest manufacturing and mining firms, as listed by Fortune magazine, was conducted in late 1979 and early 1980. About 64 percent (112 firms) responded with useful data. This Executive Summary draws on the full report (U.S. Metric Board 1979 Survey of Selected Large U.S. Firms and Industries, Lisa King, King Research, Inc., May 1980; AD-A-091-618) and provides an overview of the study's findings. Some selected findings are: (1) about 30 percent of the large firms produce at least one hard metric product; (2) about 48 percent of foreign sales are of metric products; (3) little corporate coordination and planning seems to accompany conversion to the metric system; (4) about one-third of the firms see laws and regulations as impeding conversion; (5) over 50 percent see lack of customers demand as inhibiting conversion; (6) the most realistic time period for conversion is 10 years, the minimum time for conversion (under pressure) is three years, and the preferred time (at the firm's own pace) is eight years. GRA

N81-19352# Oak Ridge National Lab., Tenn. Energy Div.
COMPUTER MODEL FOR AIR-COOLED REFRIGERANT CONDENSERS WITH SPECIFIED REFRIGERANT CIRCUITING
R. D. Ellison, F. A. Creswick, S. K. Fischer, and W. L. Jackson 1981 17 p refs Presented at the Am. Soc. of Heating, Refrig., and Air Conditioning Eng. (ASHRAE) Meeting, Chicago, 25 Jan. 1981
(Contract W-7405-eng-26)
(CONF-810101-3) Avail: NTIS HC A02/MF A01

A computer model for an air-cooled refrigerant condenser is presented; the model is intended for use in detailed design analyses or in simulation of the performance of existing heat exchangers that have complex refrigerant circuiting or unusual air-side geometries. The model relies on a tube-by-tube computational approach calculating the thermal and fluid-flow performance of each tube in the heat exchanger individually, using local temperatures and heat transfer coefficients. The refrigerant circuiting must be specified; the joining or branching of parallel circuits is accommodated using appropriate mixing expressions. Air-side heat exchange coorelations may be specified so that various surface geometries can be investigated. Results of the analyses of two condensers are compared to experiment. DOE

N81-19353# Battelle Pacific Northwest Labs., Richland, Wash.
ANALYSIS OF ALTERNATIVE STRATEGIES FOR ENERGY CONSERVATION IN NEW BUILDINGS
Jeffrey M. Fang and Jack Tawil, J. Dec. 1980 89 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3309) Avail: NTIS HC A05/MF A01

The policy instruments considered include: greater reliance on market forces; research and development; information, education and demonstration programs; tax incentives and sanctions; mortgage and finance programs; and regulations and standards. The analysis starts with an explanation of the barriers to energy conservation in the residential and commercial sectors. Individual policy instruments are described and evaluated with respect to energy conservation, economic efficiency, equity, political impacts, and implementation and other transitional impacts. Five possible strategies are identified: (1) increased reliance on the market place; (2) energy consumption tax and supply subsidies; (3) Building Energy Performance Standards (BEPS) with no sanctions and no incentives; (4) BEPS with sanctions and incentives (price control); and (5) BEPS with sanctions and incentives (no price controls). A comparative analysis is performed. Elements are proposed for inclusion in a comprehensive strategy for conservation in new buildings. DOE

N81-19354# Cornell Univ., Ithaca, N. Y. Dept. of Structural Engineering.
MICROCRACKING AND ENGINEERING PROPERTIES OF HIGH-STRENGTH CONCRETE
Ramon Luis Carrasquillo Feb. 1980 273 p refs
(Grant NSF ENG-78-05124)
(PB81-117186; NSF/RA-800238) Avail: NTIS HC A12/MF A01 CSCL 13C

An X-ray technique was used to study internal microcracking. Two classification systems were developed to analyze the microcracks: bond-mortar crack analysis and simple-combined crack analysis. Internal microcracks were observed at four strain levels. The observed microcracking mechanism is related to the failure mode in uniaxial compression. The results of the mechanical properties study are presented including data on compressive strength, strength gain with age, specimen size effect, static modulus of elasticity, Poisson's ratio, modulus of rupture, tensile splitting strength, unit weight, and drying effect on compressive and flexural strength of normal- and high-strength concretes. GRA

N81-19355# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Civil Engineering.
BEHAVIOR OF NONCOMPACTED HIGH STRENGTH BOLTED JOINTS Final Report
Arthur A. Huckelbridge, Jr., Craig J. Miller, Richard A. Burkhart, and Kwabena Asante 1 Mar. 1980 167 p refs Sponsored in part by Ohio Dept. of Transportation, Columbus Prepared in cooperation with Federal Highway Administration, Columbus, Ohio
(PB81-118416; FHWA/OH-80/004) Avail: NTIS HC A08/MF A01 CSCL 13B

All tests were continued until failure of the joint; all joints were of a butt type utilizing double lap plates and 3/4 inch A325 high strength bolts. Noncompaction ranged from the fully compacted state up to 1/8 inch difference in thickness of connected plates. Noncompaction was observed to significantly reduce the load level at which joints slip into bearing. Ultimate static loads were not affected by noncompaction, however. Under repeated loads the joints tended to slip into bearing even though nominally designed as friction connections. Fatigue failures were observed to occur through the minimum net section, usually, though not always, in the lap plates. The greatest reduction in slip load was in the shorter non-compacted joints; those with two or three bolts/row only. It is recommended that non-compaction be accounted for in these types of joints if it is necessary to maintain a friction-type connection. Non-compaction would not seem to be significant for bearing type connections. GRA

N81-19356# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
UPPER BOUND LIMIT ANALYSIS OF THE STABILITY OF A SEISMIC-INFIRMED EARTHSLOPE
S. W. Chan, S. L. Koh, and W. F. Chen Sep. 1980 141 p refs
(Grant NSF PFR-78-09326)
(PB81-117178; CE-STR-80-16; NSF/RA-800247) Avail: NTIS HC A07/MF A01 CSCL 08M

The upper bound limit analysis of perfect plasticity was applied to obtain a formulation for the critical height of a seismic-infirmed earthslope. Variation of the force magnitude and direction along the slope elevation was accounted for through two orthogonal seismic profiles. A rotational logarithmic spiral proved to be the most critical shape of sliding surface for any seismic profiles. Results for deadweight induced instability and data for constant and linear seismic profiles agree well with existing values. Appreciable reductions in critical heights for a more general

horizontal seismic profile were observed. Reductions caused by a vertical seismic profile of similar shape but with relative magnitudes of 0.1 and 0.5 times that of the horizontal profile were shown to be rather insignificant. GRA

N81-19357# ENSCO, Inc., Alexandria, Va. Transportation Group.
PAVEMENT TEXTURE MEASUREMENT STUDY: DEVELOPMENT OF A PROTOTYPE INSTRUMENT FOR REAL TIME MEASUREMENT OF PAVEMENT SURFACE TEXTURE FROM ABOARD A MOVING VEHICLE AT HIGHWAY SPEEDS Final Report, Jun. 1978 - Dec. 1979
J. Hinch, E. Howerter, and J. Zaiko Feb. 1980 88 p refs Sponsored in part by Maryland State Highway Administration, Brooklandville
(PB81-119158; FHWA/MD-80/07) Avail: NTIS HC A05/MF A01 CSCL 13B

The PTMS consists of a stroboscopic projector which emits an intense, short duration slit of light vertically downward onto the pavement surface to create an illuminated profile of the surface texture. The illuminated profiles is then detected by the photosensitive surface of the vidicon camera which views the pavement surface at a 45 degrees angle. The electronic processor digitizes the video image of the profile and records the resulting data on computer compatible digital magnetic tape. The PTMS is designed to measure samples of pavement surface texture 2.5 inches long with a resolution and accuracy of approximately 0.008 inch at vehicle speeds up to 60 mph. GRA

N81-19358# National Bureau of Standards, Washington, D.C. National Engineering Lab.
METRIC CONVERSION IN THE CONSTRUCTION INDUSTRIES, TECHNICAL ISSUES AND STATUS Final Report
Hans J. Milton and Sandra A. Berry Oct. 1980 150 p refs (PB81-111908; NBS-SP-598; LC-80-600173) Avail: NTIS HC A07/MF A01 CSCL 13M

Information is provided on technical issues and the status of metric conversion in the construction industry. Several aspects of metric standardization are discussed which include: planning consideration for the metric change; current activities of professional and industry groups; technical implications in the construction industries; dimensional coordination; metric building products and services; research issues; and timing. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-19359 Clark Univ., Worcester, Mass.
ELECTRON TRANSPORT IN AN INHOMOGENEOUS ANISOTROPICALLY SCATTERING MULTISPECIES MEDIUM Ph.D. Thesis
Ahmad Farokh Torabi 1980 84 p
Avail: Univ. Microfilms Order No. 8101199

An infinite medium Green's function is constructed for the boundary value problem of electron transport along the magnetic field lines of the Earth in an inhomogeneous anisotropically scattering medium. The goal of calculation is to obtain the photoelectron energy flux as a function of altitude, energy, and the invariant latitude. The problem involves obtaining the solution for a Boltzmann type equation using a combination of analytic and numerical techniques. Detailed transport calculations of photoelectron energy degradation processes via both inelastic collisions with neutrals and interaction with the ambient plasma are performed. A comparison is made of fluxes obtained with transport neglected (local fluxes) with those obtained with transport included (transport fluxes). The local fluxes are found to be larger than transport fluxes at low altitudes, while at high altitudes the transport fluxes are larger than local fluxes. As an illustrated calculation of the results of photoelectron fluxes, the volume excitation rates of several lines and bands of the day airglow are presented. Dissert. Abstr.

N81-19360 Washington Univ., St. Louis, Mo.
STABILITY OF ELECTROSTATIC AND MAGNETIC BERNSTEIN-GREENE-KRUSKAL EQUILIBRIA Ph.D. Thesis
Kuok Mee Ling 1980 216 p
Avail: Univ. Microfilms Order No. 8103713

The stability of electrostatic and magnetic Bernstein-Greene-Kruskal (BGK) equilibria is studied using Lewis and Symon's general formalism for the linear stability of spatially inhomogeneous Vlasov plasma equilibria with one non-ignorable coordinate. The earlier stability analysis is furthered by presenting methods for analytical rather than numerical determination of the dominant eigenfunction and eigenvalue of the modified Poisson operator in its various approximations. In the magnetic case, linearly and circularly polarized transverse equilibria are considered. For each polarization, longitudinal and transverse fluctuations are considered separately. This assumed decoupling places some perturbation (first-order) constraints on the system. One model distribution function for the linearly polarized magnetic BGK waves and two for the circularly polarized magnetic BGK waves are considered for stability. Dissert. Abstr.

N81-19361 Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Space and Ballistic Systems Div.
PRESENT AND FUTURE OF THE DIRECT TELEVISION SATELLITES
Alexandre Dauguet Paris 1980 7 p Presented at INTELCOM, Rio de Janeiro, 19-24 May, 1980
(SNIAS-801-422-103) Avail: NTIS HC A02

The joint Franco-German direct television satellite program is reviewed. The characteristics of the transmitting beam and the satellite location are described as well as mission implementation and major payload interface specifications. The client organization and industrial organization are reviewed. The characteristics of the payload module, the antenna unit, the service module and the power generator are discussed. Author (ESA)

N81-19362*# Research and Data Systems, Inc., Lanham, Md.
A STUDY OF RADIO FREQUENCY INTERFERENCE WITH THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR)
John A. Kogut 5 Nov. 1980 58 p refs
(Contract NAS5-25997)
(NASA-CR-166638) Avail: NTIS HC A04/MF A01 CSCL 20N

One of the important objectives of the NIMBUS-7 Scanning Multichannel Microwave Radiometer (SMMR) is to demonstrate the feasibility of all weather measurements of various ocean parameters; such as sea surface temperature (SST) and near surface wind speed (WS). These ocean parameters can be determined from multispectral measurements of ocean brightness temperatures in the microwave region of the electromagnetic spectrum. These microwave measurements, however, are distorted if the field of view of the SMMR antenna encounters radio transmissions from terrestrial sources. Sources of terrestrial Radio Frequency Interference (RFI) in the SMMR ocean data were identified. Its extent and characteristics over different ocean areas on the Earth were determined. T.M.

N81-19363# Istituto Elettrotecnico Nazionale, Torino (Italy).
PROBLEMS IN FREQUENCY SYNTHESIS IN THE FIR REGION
A. DeMarchi 1980 8 p refs Repr. from course proceedings, 1980 p 811-815 Proceedings of the 68th course, Metrologia e Costanti Fondamentali, Varenna, Italy, 12-24 Jul. 1976
(Rept-1768) Avail: NTIS HC A02/MF A01

When a very narrow line width is required of a synthesized signal, one should work at a frequency well below the carrier collapse frequency of the system in use. In order to get a higher v (col) two approaches may be followed. One is to use a source with a lower phase noise modulation and obviously a multiplier whose first stages are good enough not to introduce phase noise themselves. The other is to introduce somewhere on the chain a very narrow filter which cleans the signal cutting the noise sidebands. Such a filter could be a superconducting cavity at X band. The best solution at this point of the technical

development appears to be the use of a parametric oscillator at liquid He temperatures referred to a superconducting cavity. E.D.K.

N81-19364*# Ford Aerospace and Communications Corp., Palo Alto, Calif. Western Development Labs. Div.
A STUDY AND EXPERIMENT PLAN FOR DIGITAL MOBILE COMMUNICATION VIA SATELLITE Final Report
J. J. Jones, E. J. Craighill, R. G. Evans, A. D. Vincze, and N. N. Tom 30 Nov. 1978 165 p refs
(Contract NAS2-9936)
(NASA-CR-152213; WDL-TR7957) Avail: NTIS HC A08/MF A01 CSCL 17B

The viability of mobile communications is examined within the context of a frequency division multiple access, single channel per carrier satellite system emphasizing digital techniques to serve a large population of users. The intent is to provide the mobile users with a grade of service consistant with the requirements for remote, rural (perhaps emergency) voice communications, but which approaches toll quality speech. A traffic model is derived on which to base the determination of the required maximum number of satellite channels to provide the anticipated level of service. Various voice digitalization and digital modulation schemes are reviewed along with a general link analysis of the mobile system. Demand assignment multiple access considerations and analysis tradeoffs are presented. Finally, a completed configuration is described. M.G.

N81-19365*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PRELIMINARY STUDY OF A VERY LARGE SPACE RADIOMETRIC ANTENNA
Pradeep K. Agrawal Jan. 1979 45 p refs
(NASA-TM-80047) Avail: NTIS HC A03/MF A01 CSCL 20N

An approach used to compute the size of a special radiometric reflector antenna is presented. Operating at 1 GHz, this reflector is required to produce 200 simultaneous contiguous beams, each with a 3 dB footprint of 1 km from an assumed satellite height of 650 km. The overall beam efficiency for each beam is required to be more than 90%. Author

N81-19366*# Auburn Univ., Ala. Dept. of Electrical Engineering.
CHARACTERIZATION AND MODELING OF RADIATION EFFECTS NASA/MSFC SEMICONDUCTOR DEVICES Final Report
David V. Kerns, Jr. and Koy B. Cook, Jr. Dec. 1978 144 p refs
(Contract NAS8-32634)
(NASA-CR-161281) Avail: NTIS HC A07/MF A01 CSCL 20N

A literature review of the near-Earth trapped radiation of the Van Allen Belts, the radiation within the solar system resulting from the solar wind, and the cosmic radiation levels of deep space showed that a reasonable simulation of space radiation, particularly the Earth orbital environment, could be simulated in the laboratory by proton bombardment. A 3 MeV proton accelerator was used to irradiate CMOS integrated circuits fabricated from three different processes. The drain current and output voltage for three inverters was recorded as the input voltage was swept from zero to ten volts after each successive irradiation. Device parameters were extracted. Possible damage mechanisms are discussed and recommendations for improved radiation hardness are suggested. A.R.H.

N81-19367*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OPTICAL DATA TRANSMISSION TECHNOLOGY FOR FIXED AND DRAG-ON STS PAYLOADS UMBILICALS. VOLUME 1: EXECUTIVE SUMMARY
Richard W. St. Denis Jan. 1981 5 p refs
(Contract NAS10-9784)
(NASA-CR-166825-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17B

The feasibility of using optical data handling methods to transmit payload checkout and telemetry is discussed. Optical communications are superior to conventional communication systems for the following reasons: high data capacity optical channels; small and light weight optical cables; and optical signal immunity to electromagnetic interference. Task number one analyzed the ground checkout data requirements that may be expected from the payload community. Task number two selected the optical approach based on the interface requirements, the location of the interface, the amount of time required to reconfigure hardware, and the method of transporting the optical signal. Task number three surveyed and selected optical components for the two payload data link. Task number four makes a qualitative comparison of the conventional electrical communication system and the proposed optical communication system. S.F.

N81-19368*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OPTICAL DATA TRANSMISSION TECHNOLOGY FOR FIXED AND DRAG-ON STS PAYLOAD UMBILICALS, VOLUME 2 Final Report
Richard W. St. Denis Jan. 1981 118 p refs
(Contract NAS1-09784)
(NASA-CR-166825-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 17B

Optical data handling methods are studied as applicable to payload communications checkout and monitoring. Both payload umbilicals and interconnecting communication lines carrying payload data are examined for the following: (1) ground checkout requirements; (2) optical approach (technical survey of optical approaches, selection of optimum approach); (3) survey and select components; (4) compare with conventional approach; and (5) definition of follow on activity. S.F.

N81-19369*# National Aeronautics and Space Administration, Washington, D. C.
SENSORS AND METHODS FOR WEATHER-INDEPENDENT REMOTE SENSING WITH MICROWAVES
W. Keydel Mar. 1981 23 p refs Transl. into ENGLISH from DFVLR Nachrichten, (West Germany), v. 31, Nov. 1980 p 34-40 Original language document announced as A81-15708 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. for High Frequency Technology, DFVLR, Oberpfaffenhofen, West Germany
(Contract NASw-3198)
(NASA-TM-76567) Avail: NTIS HC A02/MF A01 CSCL 17I

Sensors and methods of radar and microwave radiometry which operate in the millimeter wave range are discussed. The properties of electromagnetic waves are discussed as well as the resolution capacity and measurement accuracy of sensor systems. R.C.T.

N81-19370# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
SOUTH AMERICAN FLIGHT TEST REPORT Interim Test Report, 1 Mar. - 30 Apr. 1979
Allen L. Johnson, Robert C. Beach, Wayne O. Fischeach, Ralph N. Wright, and Wade T. Hunt Oct. 1980 64 p refs
(AF Proj. 1227)
(AD-A093818; AFWAL-TR-80-1079) Avail: NTIS HC A04/MF A01 CSCL 20/14

A flight test was conducted into the equatorial region to investigate UHF ionospheric scintillation fading. The test involved the Avionics Laboratory SATCOM-equipped aircraft and the Air Force Geophysics Laboratory flying ionospheric laboratory. Equatorial UHF ionospheric scintillation fading was encountered approximately 25% of test period. A multipath fading mitigation technique was tested which utilizes signals received on bottom and top mounted antennas to reduce the fading effect. The ASC-28 Dual Frequency SATCOM terminal was evaluated during the test flights. The performance of the EHF and SHF antennas during zenith operation was successfully demonstrated. The ASC-31 1 kw UHF power amplifier was tested using the ARC-171 UHF transceiver as a driving source. GRA

N81-19371# Atlantic Research Corp., Rome, N.Y.
SPACE-BASED RADAR ARRAY SYSTEM SIMULATION AND VALIDATION Interim Report, 7 Mar. 1979 - 7 Mar. 1980
Harvey K. Schuman, Donald R. Pflug, and Larry D. Thompson Griffiss AFB, N.Y. RADC Sep. 1980 176 p refs
(Contract F30602-79-C-0116; AF Proj. 4506)

(AD-A093493; RADC-TR-80-294) Avail: NTIS HC A09/MF A01 CSCL 17/9

The simulation theory and software implementation for a space-based radar RF lens are described. Infinite array theory and moment methods are used to simulate the mutual coupling among the wire radiators on each lens array face, 'feedback' coupling from the nonilluminated array to the illuminated array, active progressively phased modules interconnecting the arrays, and arbitrarily shaped thin wire radiating elements. Edge effects are accounted for by iterative techniques. Active impedances, element currents, and power gain patterns are computed. GRA

N81-19372# Naval Ocean Systems Center, San Diego, Calif.
VLF/LF ATMOSPHERIC NOISE RECORDER: THEORY, OPERATION AND MAINTENANCE Final Report, Feb. 1979 - Jul. 1980
R. K. Cernius 25 Jul. 1980 76 p
(AD-A095034; NOSC/TD-369) Avail: NTIS HC A05/MF A01 CSCL 20/14

An analog noise recording system is described which is capable of 80-dB dynamic range recording and playback of vlf/lf noise phenomena in bandwidths up to 3 kHz. GRA

N81-19373# Massachusetts Inst. of Tech., Cambridge.
PARAMETER ESTIMATION ACCURACY FOR RADAR TARGETS CLOSELY SPACED IN RANGE
Chaw-Bing Chang 12 Nov. 1980 52 p refs
(Contract F19628-80-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A094727; TN-1980-46; ESD-TR-80-220) Avail: NTIS HC A04/MF A01 CSCL 17/9

In this report, we discuss the amplitude, location, and the relative separation estimation accuracy of radar targets closely spaced in range using the Cramer-Rao bound. It is assumed that the phases of successive signals are coherent and therefore contain relative line-of-sight location information. It is shown that this information can substantially reduce the estimation error when compared with the case where the relative signal phase is random. GRA

N81-19374# Advanced Research and Applications Corp., Sunnyvale, Calif.
CHARACTERIZATION OF PHOTOELECTRON EMISSION FOR SGEMP ANALYSIS Final Report, 1 Jan. 1979 - 30 Apr. 1980
Melvin J. Bernstein 1 May 1980 123 p refs
(Contracts DNA001-79-C-0101; DNA001-77-C-0129)
(AD-A095172; ARACOR-TR-38-2; DNA-5395F) Avail: NTIS HC A06/MF A01 CSCL 20/14

Photoelectron emission characteristics from SGEMP-relevant materials have been determined using both pulsed and steady state x radiation in the 1-6 keV range. The photoemission parameters determined were spectral yields of primary electrons and total yields of secondary electrons. A magnetic spectrometer was developed to determine the time resolved spectral yields of primary electrons generated by pulsed plasma radiation; the total yields were measured using X-ray diodes. To determine the yields of primary and secondary electrons generated by steady state monochromatic X-rays, a retarding potential method was used. The spectral yields generated by monochromatic radiation were also determined using a magnetic spectrometer. Emitter materials included the following conductors and dielectrics: aluminum, anodized aluminum, gold, silver, copper, glass, silicon, graphite, Mylar, Kapton, Teflon, solar cell cover glass and white thermal paint. Those materials studied using both the pulsed and steady state radiation exhibited good agreement primary yields. Each primary electron energy spectrum was consistent with atomic absorption edges in the material. GRA

N81-19375# Atlantic Research Corp., Alexandria, Va.
COMMUNICATIONS-ELECTRONIC INTRASYSTEM ELECTROMAGNETIC INTERFERENCE MEASUREMENT TECHNIQUES AND INSTRUMENTATION Final Report, 20 Jun. 1979 - 20 Jun. 1980
Lester E. Polisky and John W. Savage Fort Monmouth, N.J. Army Communications Research and Development Command. Dec. 1980 83 p refs
(Contract DAAK80-79-C-0786; DA Proj. 1L1-62701-AH-92)
(AD-A094757; CORADCOM-79-0786-F) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report concludes the results obtained during the Communications-Electronics Intrasystem Electromagnetic Interference Measurement Techniques and Instrumentation Project. The major effort consisted of an IEMCAP feasibility study, development of a broadband measurement technique from below 14 kHz to over 100 GHz, development of a distance transfer function accurate in both the near and far field and preparation of a draft Intrasystem EMC Measurement Standard. GRA

N81-19376# General Electric Co., Utica, N. Y., Aircraft Equipment Div.
VIDEO BANDWIDTH COMPRESSION SYSTEM Final Report, 15 Sep. 1978 - 15 Nov. 1979
David Ludington Wright-Patterson AFB, Ohio AFWAL Aug. 1980 69 p
(Contract F33615-78-C-1401; AF Proj. 2345)
(AD-A094698; AFWAL-80-1113) Avail: NTIS HC A04/MF A01 CSCL 17/2

The objective of this program was the development of a Video Bandwidth Compression brassboard model for use by the Air Force Avionics Laboratory, Wright-Patterson Air Force Base, in evaluation of bandwidth compression techniques for use in tactical weapons and to aid in the selection of particular operational modes to be implemented in an advanced flyable model. The bandwidth compression system is partitioned into two major divisions: the encoder, which processes the input video with a compression algorithm and transmits the most significant information; and the decoder where the compressed data is reconstructed into a video image for display. GRA

N81-19377# Haskins Labs., New Haven, Conn.
SPEECH RESEARCH: A REPORT ON THE STATUS AND PROGRESS OF STUDIES ON THE NATURE OF SPEECH, INSTRUMENTATION FOR ITS INVESTIGATION, AND PRACTICAL APPLICATIONS status Report, 1 Apr. - 30 Jun. 1980
Alvin M. Liberman 30 Jun. 1980 242 p refs
(Contract N01-HD-1-2420; Grants HD-01994; RR-05596; NSF MCS-79-16177; NSF BNS-78-27331; NS-13870; NS-13617; AM-25814)
(AD-A095062; SR-62(1980)) Avail: NTIS HC A11/MF A01 CSCL 17/2

This report (1 April - 30 June) is one of a regular series on the status and progress of studies on the nature of speech, instrumentation for its investigation, and practical applications. Manuscripts cover the following topics: The perceptual equivalance of two acoustic cues for a speech contrast is specific to phonetic perception; Duplex perception of acoustic patterns as speech and nonspeech; Evidence for phonetic processing of cues to place of articulation: Perceived manner affects perceived place; Some articulatory correlates of perceptual isochrony; Effects of utterance continuity on phonetic judgments; Laryngeal adjustments in stuttering: A glottographic observation using a modified reaction paradigm; Missing -ing in reading: Letter detection errors on word endings; Speaking rate; syllable stress, and vowel identity; Sonority and syllabicity: Acoustic correlates of perception, Influence of vocalic context on perception of the (S)-(s) distinction. GRA

N81-19378# Kansas Univ. Center for Research, Inc., Lawrence.
A STUDY OF ADAPTIVE IMAGE COMPRESSION TECHNIQUES Final Report, 1 Jun. 1978 - 1 Jun. 1979
Robert M. Haralick and Ronald L. Klein Wright-Patterson AFB, O. AFWAL Feb. 1980 332 p refs
(Contract F33615-78-C-1545; AF Proj. 7662)
(AD-A094678; AFWAL-TR-80-1072) Avail: NTIS HC A15/MF A01 CSCL 17/2

This is a final report on the investigation of adaptive bit algorithm concepts for video image compression. Adaptive bit algorithms, using differential pulse code modulation (DPCM) and the discrete cosine transformation (DCT) with root mean squared (rms) error as a performance criterion have been derived using analytical and experimental procedures. The resulting algorithms have been implemented via software programs and their performance assessed via comparisons with fixed bit assignment procedures. Results are presented in quantitative form (i.e., rms error) as well as visual quality. GRA

N81-19379# RAND Corp., Santa Monica, Calif.
CONCEPTS OF SIGNAL ACQUISITION AND PROCESSING FOR USE WITH A PASSIVE SPACE COMMUNICATION ARRAY Interim Report
James C. Springett Jul. 1980 54 p refs
(Contract MDA903-78-C-2081; ARPA Order 3584)
(AD-A094824; RAND/N-1550-ARPA) Avail: NTIS HC A04/MF A01 CSCL 17/6

A passive communication satellite is attractive for relaying strategic messages between distant points under conditions where active communication satellite and other terrestrial links have been negated. This note addresses two problems associated with efficient passive communication satellite use: (1) signal acquisition and (2) correction for array near-field signal degradation. A signal transfer model is developed for the satellite array, from which various fundamental properties are derived and used to assess the magnitude of the problems. Solutions are then proposed and evaluated with respect to practical implementations. GRA

N81-19380# Rome Air Development Center, Griffiss AFB, N.Y.
THE SIGNIFICANCE OF DATA COLLECTION PARAMETERS WHEN UTILIZING RADAR AND DIGITAL TERRAIN MODELS TO LOCATE TERRAIN FEATURES
Robert H. Brock, Jr. (State Univ. of New York Coll. of Environ. Science and Forestry) and Donald I. Zulch 1980 55 p refs (AF Proj. 4519)
(AD-A094816; RADC-TR-80-312) Avail: NTIS HC A04/MF A01 CSCL 08/6

The combination of cartographic and hypsographic data with radar data can generate the location of terrain features in the ground reference system. The significance of selected data collection parameters used in this task is investigated in three phases: (1) the development of deterministic radar models from given digital terrain models and varying radar parameters, (2) the perturbation of the terrain feature coordinates which result from errors in radar position, radar orientation, range, and resolution, and (3) a factorial analysis of the terrain feature errors to establish the significance of the main fixed factors and their interactions. The main factors are azimuth from radar to terrain feature, range, resolution, terrain height and coordinate. The results indicate that the order of greatest to least importance for the factors is coordinate, range, resolution, terrain height and azimuth. GRA

N81-19381# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
WAVE PROPAGATION PROBLEMS IN CERTAIN ELASTIC ANISOTROPIC HALF SPACES Ph.D. Thesis
Constantine G. Caracostis and Arthur R. Robinson Dec. 1980 213 p refs
(Contract N00014-75-C-0164)
(AD-A094763; UILU-ENG-80-2022) Avail: NTIS HC A10/MF A01 CSCL 12/1

The Smirnov-Sobolev method of self-similar potentials is used to solve certain wave propagation problems in anisotropic media. The solutions are expressed in terms of analytic functions which are determined from the boundary conditions in a straightforward manner. Two types of problems are considered. The first type concerns the two dimensional case of an orthotropic material under plain-strain conditions subjected to a suddenly applied line force on the surface or in the interior of a half space. The second type treats the three dimensional problem of a point force suddenly applied on the surface of a transversely isotropic half space. This solution is formed, in general, by a rotational superposition of the solutions for a plane strain and for an antiplane problem with appropriately defined boundary conditions. The mapping of the wave fields in the complex domain composed of a four-sheeted Riemann surface is examined in detail. Some of the techniques used in the numerical treatment of certain singularities are briefly discussed. The numerical results are given in the form of the time histories for the displacements and stresses in the two dimensional case and as time histories of only the displacements in the three dimensional case. GRA

N81-19382# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden). MI Div.
DEVELOPMENT AND TEST OF A MULTIBEAM ARRAY PAYLOAD FOR SATELLITE COMMUNICATION WITH MOBILES
P. Charas 6 Mar. 1980 6 p Sponsored by ESA
(MI-A-0094) Avail: NTIS HC A02/MF A01

A multibeam array payload for satellite communication with mobiles was developed, built and tested. The multiple beam system is of a planar phased array type. Beamforming is performed at IF and power amplification is performed at RF behind the antenna elements. Special hardware developed includes an array of 18 short backfire elements, 18 L band linear power amplifiers, temperature compensated dielectric resonator diplexers and a 19 x 18 beamforming network at IF. A multibeam transmit system was integrated using the above mentioned hardware together with beamswitching equipment, and interface equipment for testing. Tests were performed on a fully automatic far field outdoor range, and predicted system performance was verified. It was demonstrated that a powerful multibeam array payload is feasible for use in a global communications system with mobiles. Author (ESA)

N81-19383# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden).
INTERNATIONAL SOLAR POLAR MISSION: HIGH GAIN ANTENNA REFLECTOR TOLERANCES
Magnus Bonnedal 28 Nov. 1979 7 p
(MI-A-9329) Avail: NTIS HC A02/MF A01

The influence of reflector surface deformation on antenna gain is studied considering deformations of a best fit parabola. Distorted reflector forms were fed into the GRASP 2 computer program using a theoretical X-band feed at 8.4 GHz. Blocking from a central feed and three struts were also included. The calculated results show a gain loss proportional to the mean of squares and independant of the detailed form of the error or the maximum error. Author (ESA)

N81-19384# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden).
INTERNATIONAL SOLAR POLAR MISSION: ALIGNMENT METHODS FOR THE HIGH GAIN ANTENNA
S. Larsson 13 Feb. 1980 14 p
(MI-GT-0020; IS-TN-LM-0027) Avail: NTIS HC A02/MF A01

Two methods for antenna alignment are described and compared. In one case the turntable's roll axis serves as a reference; in the other case the optical axis of a TV camera serves as a reference. Both methods are considered sufficiently accurate. The differences with respect to convenience and sensitivity to disturbances are analyzed. Author (ESA)

N81-19385# Telefonaktiebolaget L. M. Ericsson, Stockholm (Sweden).
WIRE GRID POLARIZERS
Lars Josefsson 11 Nov. 1977 125 p
(MI-Kv-7066) Avail: NTIS HC A06/MF A01

The analysis and synthesis of wire grid polarizers for microwave antennas is studied. Both transmission and reflection type polarizers are treated. Design equations for reflection polarizers with one and two wire grids are derived. A numerical optimization technique is used in studying transmission polarizers. A computer program is described which can be used for optimization and analysis of twist reflectors and transmission polarizers for circular polarization. Comparisons of theoretical and measured performance are presented. Author (ESA)

N81-19386# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
TRANSDUCERS AND MATCHING CONDITIONS FOR RESONANT GRAVITATIONAL WAVE ANTENNAS
G. V. Pallottino Mar. 1980 118 p refs Prepared in cooperation with Rome Univ.
(LPS-80-5) Avail: NTIS HC A06/MF A01

The signal and noise response of a gravitational wave antenna with resonant and nonresonant transducers is analyzed. An expression of the sensitivity, i.e., minimum detectable spectral energy density of the gravitational radiation, in terms of the ratio between an effective temperature and the antenna mass is derived. The effective temperature depends on the temperature of the bar, on the noise temperature of the transducer, on the matching between bar and transducer and on the data analysis algorithm. For both resonant and nonresonant transducers

expressions for the optimum matching conditions are derived. The effective temperatue becomes equal to twice the noise temperature of the transducer provided the Wiener-Kolmogoroff algorithm is used in the data analysis. Author (ESA)

N81-19387# Oulu Univ. (Finland). Dept. of Electrical Engineering.
THE THEORETICAL PERFORMANCE OF A NEW ARRAY ANTENNA CONFIGURATION FOR MEDIUM AND LONG DISTANCE HF COMMUNICATION
Simo Lehto 1978 44 p refs Sponsored by Found. of Walter Ahlstroem Suomen Kulttuurirahasto, Found. Oulun Yliopiston Tukisaeaetioe and Found. Tauno Toenning
(Rept-S-50-1978; ISBN-9-5142-0523-5; ISSN-0356-0899) Avail: NTIS HC A03/MF A01

Computer simulations were performed using an interactive computer program based on a mathematical model of an arbitrary HF array antenna located above imperfect ground. The arrays described are rotatable 360 deg in azimuth and steerable over the desired elevation angles. The proposed configuration is a fully developed economical solution to most present medium and long distance HF transmission and shows a power gain exceeding that of rotatable log periodic antennas by an order of magnitude. Author (ESA)

N81-19388# Weapons Systems Research Lab., Adelaide (Australia).
FREQUENCY WAVENUMBER BEAMFORMING BY USE OF THE TWO DIMENSIONAL FOURIER TRANSFORM
D. A. Gray Jul. 1980 34 p refs
(PB81-120214; WSRL-0162-TR; AR-002-006) Avail: NTIS HC A03/MF A01 CSCL 17B

The concept of frequency wavenumber beamforming of a linear array of equispaced receivers is reviewed. The frequency wavenumber spectrum can be evaluated by using a two dimensional Fast Fourier Transform and the properties of the resulting estimate of the frequency wavenumber spectrum are described. Particular attention is given to the distortion of the spectral power extimates due to leakage of negative frequency components. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-19389* National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR USE IN THE PRODUCTION OF RIBBON-SHAPED CRYSTALS FROM A SILICON MELT Patent
Samuel Berkman (RCA Corp., Princeton, N.J.) and Harold E. Temple, inventors (to NASA) (RCA Corp., Princeton, N.J.) Issued 30 Dec. 1980 6 p Filed 31 Aug. 1978 Supersedes N79-10918 (17-01, p 0122) Sponsored by NASA
(NASA-Case-NPO-14297-1; US-Patent-4,242,553; US-Patent-Appl-SN-938299; US-Patent-Class-219-10.49R; US-Patent-Class-219-10.67; US-Patent-Class-422-246; US-Patent-Class-422-249; US-Patent-Class-156-608; US-Patent-Class-156-DIG.96; US-Patent-Class-432-264) Avail: US Patent and Trademark Office CSCL 09A

A susceptor for facilitating induction heating of silicon melt is described. The susceptor comprises a pair of susceptor halves of a thickness less than two skin depths, each being the mirror image of the other, disposed in mutually opposed, electrically insulated relation. The crucible comprises a quartz body supported by the graphite susceptor, whereby the R-F coil is electrically coupled with the melt.

Official Gazette of the U.S. Patent and Trademark Office

N81-19390 Cornell Univ., Ithaca, N. Y.
A STUDY OF THE DEVICE AND MATERIALS RELATED ASPECTS OF THE MICROWAVE GALLIUM ARSENIDE POWER MESFET Ph.D. Thesis
Sandip Tiwari 1980 229 p
Avail: Univ. Microfilms Order No. 8103002

The problem in the area of power MESFETs related to both the device properties and the materials properties are addressed. Limits on drain source and drain gate breakdown voltages were extended by using a geometry with recessed active channel, a separately recessed gate, and extended drain to gate spacing. An investigation of the electrical behavior of the device by in-situ profiling of bulk high electric field regions and the surface voltage distribution revealed an avalanche mechanism as the cause of burnout. In order to study the leakage behavior the state of the art of the multiple well sliding boat liquid phase epitaxy system was advanced to grow MESFET device quality multiple layer structures with high purity GaAs buffer layers. Cr-doped semi-insulating buffer layers and high purity Ga sub 1-x Al sub-As buffer layers. Additional results are discussed. Dissert. Abstr.

N81-19391 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A DISCRETE TIME MODEL OF A POWER CONDITIONER FED PERMANENT MAGNET BRUSHLESS DC MOTOR SYSTEM FOR AEROSPACE AND ELECTRIC VEHICLE APPLICATIONS FOR DESIGN PURPOSE USING FINITE ELEMENTS FOR MACHINE PARAMETER DETERMINATION Ph.D. Thesis
Thomas Wolfgang Nehl 1980 283 p
Avail: Univ. Microfilms Order No. 8101894

A discrete state space model of a power conditioner fed permanent magnet brushless dc motor for aerospace and electric vehicle applications is developed. The parameters which describe that machine portion of this model are derived from a two dimensional nonlinear magnetic field analysis using the finite element method. The model predicts the instantaneous mechanical and electrical behavior of a prototype electromechanical actuator for possible use on board the shuttle orbiter. The model is also used to simulate the instantaneous performance of an advanced electric vehicle propulsion unit. The results of the computer simulations are compared with experimental test data and excellent agreement between the two is found in all cases.

Dissert. Abstr.

N81-19392* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BUCK/BOOST REGULATOR Patent
John Paulkovich and G. Ernest Rodriguez, inventors (to NASA) Issued 13 Jan. 1981 8 p Filed 21 May 1979 Supersedes N79-27394 (17 - 18, p 2399)
(NASA-Case-GSC-12360-1; US-Patent-4,245,286; US-Patent-Appl-SN-041164; US-Patent-Class-363-21; US-Patent-Class-363-101) Avail: US Patent and Trademark Office CSCL 09A

A voltage regulated DC to DC converter uses an inductor and a capacitor as storage elements. The inductor is composed of two windings having a common junction. A transformer with a center tap connected to the common junction of the two windings is connected at either end of its winding to ground through controlled switches. One winding of the inductor and either end of the transformer winding are connected by power diodes to the capacitor which supplies the output voltage to a load. The other winding of the inductor is connected to a fourth power diode as a clamping diode. Input voltage is supplied to the inductor through a third controlled switch. A pulse width modulator connected to the output of the converter alternately closes and opens the switches connected to either end of the transformer winding and also closes the switch supplying input voltage to the inductor each time either of the switches connected to the ends of the transformer winding are closed. The duty cycle of the closing and opening of the several switches is adjusted by the pulse modulator to regulate the output voltage.

Official Gazette of the U.S. Patent and Trademark Office

N81-19393* National Aeronautics and Space Administration. Pasadena Office, Calif.
ELIMINATION OF CURRENT SPIKES IN BUCK POWER CONVERTERS Patent
William T. McLyman, inventor (to NASA) (JPL, California Inst. of Technology, Pasadena) Issued 13 Jan. 1981 9 p Filed

31 Oct. 1978 Sponsored by NASA
(NASA-Case-NPO-14505-1; US-Patent-4,245,288; US-Patent-Appl-SN-956166; US-Patent-Class-363-40; US-Patent-Class-363-21; US-Patent-Class-363-36; US-Patent-Class-363-47) Avail: US Patent and Trademark Office CSCL 09C

Current spikes in a buck power converter due to commutating diode turn-off time are eliminated by using a tapped inductor in the converter with the tap connected to the switching transistor. The commutating diode is not in the usual place, but is instead connected to conduct current from one end of the tapped inductor remote from the load during the interval in which the transistor is not conducting. In the case of a converter having a center-tapped (primary and secondary) transformer between two switching power transistors operated in a push-pull mode and two rectifying diodes in the secondary circuit, current spikes due to transformer saturation are also eliminated by using a tapped inductor in the converter with the tap connected to the rectifying diodes and a diode connected to conduct current from one end of the tapped inductor remote from the load during the interval in which the transistors are not conducting.

Official Gazette of the U.S. Patent and Trademark Office

N81-19394*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL ROTARY JOINT APPARATUS FOR LARGE SPACE STRUCTURES Patent Application
Robert R. Belew and Richard J. Boehme, inventors (to NASA) Filed 4 Feb. 1981 19 p
(NASA-Case-MFS-23981-1; US-Patent-Appl-SN-231543) Avail: NTIS HC A02/MF A01 CSCL 09C

A structural array and electrical rotary joint for transmitting an electrical power between large space structures having relative rotational movement therebetween is disclosed as including large support framework structures which rotate relative to one another about a common axis of rotation. The arrangement of cylindrical hub members and associated support structure in combination with the electrical conductor and bearings enable transmission of large amounts of electrical power from structures such as a solar array to a microwave antenna while maintaining a high degree of dimensional stability. Author

N81-19395*# SRI International Corp., Menlo Park, Calif. Physical Electronics Group.
DEVELOPMENT PROGRAM ON A COLD CATHODE ELECTRON GUN Final Report
C. A. Spindt May 1979 82 p refs
(Contract NAS3-20096; SRI Proj. 5413)
(NASA-CR-159570; SRI-5413) Avail: NTIS HC A05/MF A01 CSCL 09A

A prototype electron gun with a field emitter cathode capable of producing 95 mA in a 1/4 mm diameter beam at 12 kV was produced. Achievement of this goal required supporting studies in cathode fabrication, cathode performance, gun design, cathode mounting and gun fabrication. A series of empirical investigations advanced fabrication technology: More stable emitters were produced and multiple cone failure caused by chain reaction discharges were reduced. The cathode is capable of producing well over 95 mA, but a substantial collector development effort was required to demonstrate emission levels in the 100 mA region. Space charge problems made these levels difficult to achieve. Recommendations are made for future process and materials investigation. Electron gun designs were modeled and tested. A pair of two-electrode gun structures were fabricated and tested; one gun was delivered to NASA. Cathodes were pretested up to 100 mA at SRI and delivered to NASA for test in the gun structure. Author

N81-19396*# Mississippi State Univ., Mississippi State. Microelectronics Research Lab.
A STUDY OF TRENDS AND TECHNIQUES FOR SPACE BASE ELECTRONICS Final Quarterly Report, 11 Dec. 1978 - 10 Mar. 1979
J. D. Trotter and T. E. Wade Apr. 1979 23 p
(Contract NAS8-26749)
(NASA-CR-161279; MSU-EE-QUAR-2-79) Avail: NTIS HC A02/MF A01 CSCL 09C

The research facilities of the Mississippi State University devoted to microelectronics are described. The fabrication and processing capabilities, computer aided design, and experimental evaluation capabilities are discussed. M.G.

N81-19397*# Mississippi State Univ., Mississippi State. Microelectronics Research Lab.
A STUDY OF TRENDS AND TECHNIQUES FOR SPACE BASE ELECTRONICS Quarterly Progress Report, 11 Sep. - 10 Dec. 1978
J. D. Trotter, T. E. Wade, and J. D. Gassaway Jan. 1979 40 p refs
(Contract NAS8-26749)
(NASA-CR-161278; MSU-EE-QUAR-79) Avail: NTIS HC A03/MF A01 CSCL 09C

The use of dry processing and alternate dielectrics for processing wafers is reported. A two dimensional modeling program was written for the simulation of short channel MOSFETs with nonuniform substrate doping. A key simplifying assumption used is that the majority carriers can be represented by a sheet charge at the silicon dioxide-silicon interface. In solving current continuity equation, the program does not converge. However, solving the two dimensional Poisson equation for the potential distribution was achieved. The status of other 2D MOSFET simulation programs are summarized. A.R.H.

N81-19398*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Electrical Engineering.
TWO DIMENSIONAL RECURSIVE DIGITAL FILTERS FOR NEAR REAL TIME IMAGE PROCESSING Final Report, 15 Sep. 1979 - 30 Dec. 1980
David Olson and Earnest Sherrod 30 Dec. 1980 194 p refs
(Grant NsG-5406)
(NASA-CR-164028) Avail: NTIS HC A09/MF A01 CSCL 09A

A program was designed toward the demonstration of the feasibility of using two dimensional recursive digital filters for subjective image processing applications that require rapid turn around. The concept of the use of a dedicated minicomputer for the processor for this application was demonstrated. The minicomputer used was the HP1000 series E with a RTE 2 disc operating system and 32K words of memory. A Grinnel 256 x 512 x 8 bit display system was used to display the images. Sample images were provided by NASA Goddard on a 800 BPI, 9 track tape. Four 512 x 512 images representing 4 spectral regions of the same scene were provided. These images were filtered with enhancement filters developed during this effort. T.M.

N81-19399# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
MONOLITHIC GaAs SUPERHETERODYNE FRONT END Progress Report, 15 Aug. 1978 - 14 Aug. 1979
Aditya K. Gupta, Wendell Petersen, and D. R. Chen May 1980 44 p refs
(Contract N00014-78-C-0624; NR Proj. 251-035)
(AD-A094263; ERC41014.1PR; PR-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the progress during the first phase of the development of a monolithic Gallium Arsenide Superheterodyne Front End for the 8 GHz military satellite communications band. The integrated GaAs receiver chip is to be fabricated using the monolithic microwave integrated circuit (MMIC) approach. It will contain an RF preamplifier, an FET mixer, and an IF amplifier. A monolithic GaAs local oscillator will be developed under a separate program. This report describes the design and the fabrication of the three circuits to be integrated. Functional monolithic circuits have been fabricated and are being characterized at present. The IF amplifier has shown 8.0 and/or -1.5 db gain and 6.35 db maximum noise figure in the 500 - 1000 MHz frequency band. RF performance of the preamplifier and the mixer will be described in the next report. GRA

N81-19400# Harry Diamond Labs., Adelphi, Md.
A REVIEW OF MODELS OF THE FLUIDIC GENERATOR Progress Report, Sep. 1978 - Sep. 1979
Richard Deadwyler 1980 43 p refs
(DA Proj. 1X4-63303-D-564)

(AD-A095028; HDL-PR-80-4) Avail: NTIS HC A03/MF A01 CSCL 19/1

The fluidic generator is a pneumatic-to-electrical transducer that provides electrical power for the fuze circuits in missiles and rockets. It consists of four subsystems: (1) the jet-forcing mechanism (the annular nozzle and the knife edge of the resonator), (2) the resonant cavity, (3) the mechanical diaphragm assembly (the diaphragm, connecting rod, and reed), and (4) the electrical circuit. The first three subsystems constitute a feedback control system, in which ram-air input to the generator is brought into oscillation with a resonant or reflecting structure controlling the feedback. Pressure feedback signals are generated by sonic reflections from (1) the knife edge, (2) the cavity (assuming that the diaphragm is not moving), and (3) the moving diaphragm. The feedback signals are summed or coupled at the nozzle exit region of the jet. This physical model shows that the generator can be forced to jump to nondesign frequencies of oscillation because any change in the potential of the input jet will change the signal propagation or convection speed in the forward path and the acoustic speed in the feedback path. Thus, the physical model provides a qualitative answer to the question of jumps in the generator operating frequency. GRA

N81-19401# Texas Instruments, Inc., Dallas. Semiconductor Group.

DESIGN OF A LOW POWER SCHOTTKY TTL HIGH-SPEED DIGITAL PHASE-LOCKED LOOP INTEGRATED CIRCUIT Final Report, 1 Apr. 1977 - 30 Jun. 1980

James D. Gallia Oct. 1980 53 p refs

(Contract F33615-77-C-1047; AF Proj. 6096)

(AD-A094729; TI-03-80-30; AFWAL-TR-80-1152) Avail: NTIS HC A04/MF A01 CSCL 09/5

A high speed digital phase locked loop (DPLL) integrated circuit was successfully designed and implemented with Low Power Schottky technology. The Avionics Laboratory sponsored the development of the SN54LS297 DPLL IC, which was designed to become a standard Texas Instruments catalog part. This device uses strictly digital techniques to perform the first order phase locked loop linear function and can be cascaded to form higher order phase filters. The center frequency and bandwidth are digitally programmable, and Q's of 8 to 130,000 can be obtained, making possible narrow bandwidth phase tracking with higher resolution than conventional phase locked loops. GRA

N81-19402# Westinghouse Electric Corp., Athens, Ga. Distribution Transformer Div.

OPTIMIZATION OF DISTIBUTION TRANSFORMER EFFICIENCY CHARACTERISTICS Final Report

H. Braunstein 4 Dec. 1979 428 p refs

(Contract DE-AC01-78ET-29298)

(DOE/ET-29298/T1) Avail: NTIS HC A19/MF A01

A method for distribution transformer loss evaluation was derived. The total levelized annual cost method was used and was extended to account properly for conditions of energy cost inflation, peak load growth, and transformer changeout during the evaluation period. The loss costs included were the no-load and load power losses, no-load and load reactive losses, and the energy cost of regulation. The demand and energy components of loss costs were treated separately to account correctly for the diversity of load losses and energy cost inflation. An analysis was performed to find what level of transformer loss yields the minimum total levelized annual cost for a given kVA rating and a given set of load and cost parameters. Initial transformer costs as a function of no-load loss, load loss, and kVA were generated and used in the evaluation. Both single and multiple efficiency designs were considered. The total levelized annual costs of the two designs were compared. In each case, the multiple efficiency design was less costly. A sensitivity analysis was performed to find the change in total levelized annual cost due to changes in the input parameters. DOE

N81-19403# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.

ANNUAL TECHNICAL PROGRAM REPORT. TASK 1: SUPERCONDUCTOR RESEARCH. TASK 2: FAR-INFRARED DIAGNOSTIC DEVELOPMENT

1980 3 p

(Contracts DE-AC02-78ET-53077; ET-78-S-02-4724)

(DOE/ET-53077/1) Avail: NTIS HC A02/MF A01

Summaries of research are given for each of the following areas: development and characterization of in situ multifilamentary superconducting materials, development and characterization of cold powder metallurgy processed multifilamentary superconductor materials, and composite micromechanics, fatigue model, and improved multifilamentary materials. Far infrared ion temperature diagnostics for high temperature plasmas are also discussed. DOE

N81-19404# Cyclomatic Industries, Inc., San Diego, Calif.

HIGHLY EFFICIENT WELDING POWER SUPPLY Final Report, 1 May 1978 - 30 Sep. 1980

J. M. Thommes Sep. 1980 103 p refs

(Contract DE-AC03-78CS-40023)

(DOE/CS-40023/T2) Avail: NTIS HC A06/MF A01

The results and findings of an energy efficient welding power development project are presented. The power source developed is to be used for electric arc welding processes in which 3.5 trillion Btu of energy can be saved annually. The power source developed incorporates the use of switch mode power supply techniques in order to convert industrial supply mains to appropriate welding voltages and currents. A series capacitor switch mode power circuit was the circuit technique chosen in order to optimize energy efficiency, costs, reliability, size/weight, and welding performance. Test results demonstrated an effective efficiency (taking into account idle power consumption) of 80 to 91 percent for the energy efficient power source while the conventional types of power sources tested ranged from 41 to 74 percent efficiency. Line power factor was also improved for the energy efficient power source. Field tests indicated additional refinements of weld process performance and power source audible noise emission reduction could be beneficial. DOE

N81-19405# Electricity Council Research Centre, Capenhurst (England).

THE STATISTICAL DISTRIBUTION OF VALUES OF BREAKDOWN VOLTAGE FOR AN AIR GAP

W. P. Baker Sep. 1979 18 p

(ECRC/M1283; Job-089) Avail: NTIS HC A02/MF A01

An analysis of 30,000 measurements of breakdown voltage on a spark gap removed from a surge diverter shows a linear relation between normal probability and the logarithm of the excess of the applied voltage over a critical voltage. This linearity extends over more than six standard deviations. A statistical model is derived which agrees well with the experimental findings and which is investigated further to show that the physical parameter of the breakdown process in air which controls the scatter of test results is the rate of change of the first Townsend coefficient with field. Author (ESA)

N81-19406# Danish Research Center for Applied Electronics, Hoersholm.

PHOTOCOUPLERS 2. A COMPARATIVE INVESTIGATION OF THE QUALITY OF EIGHT VARIANTS IN PLASTIC ENCAPSULATION, COVERING SIX MANUFACTURERS

H. J. Nordby Jul. 1980 31 p refs Sponsored by Society for Reliability and Environmental Testing

(ECR-96) Avail: NTIS HC A03/MF A01

Environmental and accelerated life tests were conducted on a sample of 320 photocouplers (6 pin and 8 pin) from six manufacturers. A group was tested 1000 hours at 93% relative humidity for 40 C, operating at 500 V DC. A second group with derated current at 70 C was used to detect degredation in light emitting diode light emission when exposed to high temperature and high DC lead current fur 1000 hours. Samples were exposed with intermittent load for 1000 hours, with ten units from each variant exposed with a collector current of 2.5 mA. Catastrophic failures occurred in 5.42 percent of the samples; a degradation failure rate of 6.6 percent was also found. Certain variants suffered 100 percent failure rates, while others showed no failures. Author (ESA)

N81-19407# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

COUPLED THERMAL AND ELECTRIC EFFECTS IN A MEDIUM INCLUDING AN INTERFACE [EFFETS THERMIQUES ET ELECTRIQUES COUPLES DANS UN MILIEU

COMPORTANT UNE INTERFACE]
R. Prudhomme Jul. 1979 84 p refs In FRENCH; ENGLISH summary
(Rept-79-3; Publ-615) Avail: NTIS HC A05/MF A01

Material interface models of discontinous systems, including internal flux and variables with non-stationary effects, are applied to the study of coupling effects between thermal and electrical interfacial transfer processes. Balance equations are established and the interfacial source term is evaluated in the presence of electric effects. Several examples are given, such as the junction between different media, with phenomenological equations written in each case in both bulk and interfacial medium; these point out the coupling between temperature and electrical potential jump at interface, chemical reactions and dielectric relaxation. Author (ESA)

N81-19408# General Electric Co., Schenectady, N. Y. Corp. Research and Development.
COMPARISONS BETWEEN DESIGNS FOR SINGLE-SIDED LINEAR ELECTRIC MOTORS: HOMOPOLAR SYNCHRONOUS AND INDUCTION Final Report, Phase 3, 15 Sep. 1975 - 30 Jul. 1978
Thomas A. Nondahl and Eike Richter Sep. 1980 114 p refs (Contract DOT-FR-64147)
(PB81-116188; FRA/ORD-80/54) Avail: NTIS HC A06/MF A01 CSCL 09C

A design study of two types of single sided (with a passive rail) linear electric machine designs, namely homopolar linear synchronous machines (LSM's) and linear induction machines (LIM's), is described. It is assumed the machines provide tractive effort for several types of light rail vehicles and locomotives. These vehicles are wheel supported and require tractive powers ranging from 200 kW to 3735 kW and top speeds ranging from 112 km/hr to 400 km/hr. All designs are made according to specified magnetic and thermal criteria. The LSM advantages are a higher power factor, much greater restoring forces for track misalignments, and less track heating. The LIM advantages are no need to synchronize the excitation frequency precisely to vehicle speed, simpler machine construction, and a more easily anchored track structure. The relative weights of the two machine types vary with excitation frequency and speed; low frequencies and low speeds favor the LSM. GRA

N81-19409# General Electric Co., Schenectady, N. Y.
PERFORMANCE OF A SINGLE-SIDED LINEAR INDUCTION MOTOR WITH SOLID BACK IRON AND WITH VARIOUS MISALIGNMENTS, VOLUME 1 Final Report, Phase 2, 15 Sep. 1975 - 15 May 1978
Gerald B. Kliman, William R. Mischler, and W. Russel Onery Sep. 1980 102 p refs
(Contract DOT-FR-64147)
(PB81-119463; SRD-78-069; FRA/ORD-80/53-1) Avail: NTIS HC A06/MF A01 CSCL 09C

A test facility was designed and built to measure all aspects of the performance of the motor. The facility was equipped and instrumented to measure all the usual performance parameters plus all of the six axis forces in normal operation and, when displaced, in the remaining five degrees of freedom (air gap, lateral, pitch, roll, and yaw). Performance in the normal position was compared to the mesh/matrix prediction. Generally good agreement was obtained between measured and predicted values of thrust and efficiency. Differences between predicted and measured thrust (especially at high slips) were related to the solid back iron and skin saturation. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-19410 Connecticut Univ., Storrs.
HYDRODYNAMIC STABILITY OF AN AXISYMMETRIC VISCOUS NON-PARALLEL JET Ph.D. Thesis
Charles Russell Weber 1980 124 p
Avail: Univ. Microfilms Order No. 8103249

The stability of the axisymmetric, asymptotic jet is studied. The fluid is of constant density and constant molecular viscosity. The medium surrounding the jet is of the same fluid and would be quiescent were it not for its interaction with the jet. The disturbances to the jet, which are periodic in time and which may grow or decay in the streamwise direction, are assumed to be small. Highly important, however, is the fact that all non-parallel effects are included to O(epsilon) by applying a multiple scales analysis. The flow case in considered laminar; that is, all turbulence effects are neglected. Dissert. Abstr.

N81-19411 Utah State Univ., Logan.
A QUANTITATIVE STUDY OF FREE AIR RELEASE DURING TRANSIENT FLOW Ph.D. Thesis
Muin Sadek Baasiri 1981 155 p
Avail: Univ. Microfilms Order No. 8104104

The phenomenon of air release during hydraulic transients in pipe flow with column separation was investigated experimentally. It is established that when line pressure during a hydraulic transient drops to the vapor pressure of the liquid column separation and cavitation bubbles occur throughout the system and that air release from saturated water is initiated towards these bubbles by the process of convective diffusion. At the time of cavity collapse, the sudden increase in pressure causes the system to agitate. This agitation significantly increases the rate of air release and with disappearance of all vapor cavities small gas bubbles scattered throughout the system are left behind. These gas bubbles cause a considerable decrease in both the wave speed of the medium and the peak pressures. From preliminary tests conducted on the model, parameters influencing the mass of released air were identified. These parameters consist of the instantaneous line pressure, the time period at low pressure, the maximum mass of releasable air, the initial mass of free air, the agitation, and the temperature of water. These variables in addition to the mass of released air were combined into a set of Piterms by the method of dimensional analysis. Dissert. Abstr.

N81-19412*# Flight Dynamics Research Corp., Van Nuys, Calif.
JET-DIFFUSER EJECTOR - ATTACHED NOZZLE DESIGN Final Report
Morton Alperin and Jiunn-Jeng Wu May 1980 41 p refs Sponsored in part by Navy
(Contract NAS2-10059)
(NASA-CR-152361) Avail: NTIS HC A03/MF A01 CSCL 20D

Attached primary nozzles were developed to replace the detached nozzles of jet-diffuser ejectors. Slotted primary nozzles located at the inlet lip and injecting fluid normal to the thrust axis, and rotating the fluid into the thrust direction using the Coanda Effect were investigated. Experiments indicated excessive skin friction or momentum cancellation due to impingement of opposing jets resulted in performance degradation. This indicated a desirability for location and orientation of the injection point at positions removed from the immediate vicinity of the inlet surface, and at an acute angle with respect to the thrust axis. Various nozzle designs were tested over a range of positions and orientations. The problems of aircraft integration of the ejector, and internal and external nozzle losses were also considered and a geometry for the attached nozzles was selected. The effect of leaks, protrusions, and asymmetries in the ejector surfaces was examined. The results indicated a relative insensitivity to all surface irregularities, except for large protrusions at the throat of the ejector. J.M.S.

N81-19413*# Stanford Univ., Calif. Dept. of Mechanical Engineering.
EXPERIMENTAL DATA AND MODEL FOR THE TURBULENT BOUNDARY LAYER ON A CONVEX, CURVED SURFACE Final Report
J. C. Gillis, J. P. Johnson, R. J. Moffat, and W. M. Kays Washington NASA Mar. 1981 305 p refs
(Grants NsG-3124; NAG3-3)
(NASA-CR-3391; HMT-31) Avail: NTIS HC A14/MF A01 CSCL 20D

Experiments were performed to determine how boundary

layer turbulence is affected by strong convex curvature. The data gathered on the behavior of the Reynolds stress suggested the formulation of a simple turbulence model. Data were taken on two separate facilities. Both rigs had flow from a flat surface, over a convex surface with 90 deg of turning and then onto a flat recovery surface. The geometry was adjusted so that, for both rigs, the pressure gradient along the test surface was zero. Two experiments were performed at delta/R approximately 0.10, and one at weaker curvature with delta/R approximately 0.05. Results show that after a sudden introduction of curvature the shear stress in the outer part of the boundary layer is sharply diminished and is even slightly negative near the edge. The wall shear also drops off quickly downstream. When the surface suddenly becomes flat again, the wall shear and shear stress profiles recover very slowly towards flat wall conditions. A simple turbulence model, which was based on the theory that the Prandtl mixing length in the outer layer should scale on the velocity gradient layer, was shown to account for the slow recovery.
E.D.K.

N81-19414*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
A CLASS OF UNSTEADY, THREE-DIMENSIONAL FLOW STRUCTURES IN TURBULENT BOUNDARY LAYERS Final Report, 1 Sep. 1979 - 31 Aug. 1980
Robert L. Ash Mar. 1981 12 p refs
(Grant NsG-1634)
(NASA-CR-164036) Avail: NTIS HC A02/MF A01 CSCL 20D

A restricted class of mathematically admissible, unsteady, three dimensional flows was identified which may constitute part of the structure observed in turbulent boundary layers. The development of the model and some general results are discussed. The resulting solution has characteristics which suggest how upwelling low speed flow can trigger a downward jetting of irrotational high speed fluid into the boundary layer. E.D.K.

N81-19415# ARO, Inc., Arnold Air Force Station, Tenn.
BOUNDARY-LAYER TRANSITION ON LARGE-SCALE CMT GRAPHITE NOSETIPS AT REENTRY CONDITIONS Final Report, 26 Jan. - 10 Aug. 1978
R. M. Raper AEDC Jan. 1981 44 p refs
(AD-A094212; AEDC-TR-79-45) Avail: NTIS HC A03/MF A01 CSCL 20/4

A series of tests designed to investigate the boundary layer transition characteristics of preablated CMT graphite nosetips was conducted in a hypervelocity track facility. The location of the zone at which transition from laminar to turbulent flow occurred was measured on a number of nosetips having radii of 0.40, 0.80, and 1.125 in. The nosetips were tested at nominally 16 kfps over a free stream pressure range of 0.13 to 0.40 atm. Transition front locations were inferred from nosetip surface temperature distributions obtained using a photographic pyrometry technique and fronts were observed to range from the proximity of the stagnation point to the sonic point. It was observed that the mean transition location moved forward on the nosetip as test pressure increased. The circumferential variations about the mean transition location over a given nosetip decreased as the mean location moved nearer to the stagnation point. GRA

N81-19416# Naval Research Lab., Washington, D. C. Applied Mechanics Branch.
A COMPARISON OF TWO-STEP TIME INTEGRATION SCHEMES FOR THE FINITE ELEMENT ADVECTION EQUATION Interim Report
Richard A. Skop, George A. Keramidas, and Michael L. Morrell (Cornell Univ.) 19 Jan. 1981 92 p refs
(RR0230141)
(AD-A094533; NRL-MR-4438) Avail: NTIS HC A05/MF A01 CSCL 20/9

Numerical studies of two explicit, two step time integration techniques for the one dimensional, constant velocity finite element advection equation have been conducted for both square hill and cosine hill density distributions. One of these integration techniques, the Godunov scheme, is first order accurate in time while the other, the Lax-Wendroff scheme, is second order accurate in time. The results show that, overall, the 'best' numerical solutions are obtained by combining a central weighted first step Lax-Wendroff time integration with parabolic spatial discretization either in its full or condensed M matrix form. Both the standard and central weighted first step Godunov time integrations are found to be numerically diffusive. This diffusivity tends to override whatever spatial discretization is used. However, the positivity property possessed by the Godunov schemes can be valuable for many applications. GRA

N81-19417# Princeton Univ., N. J. Labs of Physics.
SYMMETRY BREAKING FAR FROM EQUILIBRIUM
L. Sneddon 21 Jan. 1981 17 p refs
(Contract N00014-77-C-0711)
(AD-A094972) Avail: NTIS HC A02/MF A01 CSCL 20/13

An examination of the Rayleigh-Benard convection experiment shows that the defining features of long-range order and spontaneous symmetry breaking as they occur in equilibrium transitions, are also observed far from equilibrium. The broken symmetry is not, as has been suggested, translational invariance, but rather a discrete symmetry under velocity reversal. Some experimental consequences of these observations are outlined. GRA

N81-19418# Stanford Univ., Calif. Joint Inst. of Aeronautics and Acoustics.
BASIC STUDIES OF MULTIPLE JETS AND WALL JETS Final Report, Jul. 1979 - Aug. 1980
A. Krothapalli Aug. 1980 23 p refs
(Contract F49620-79-C-0189; AF Proj. 2307)
(AD-A094626; AFOSR-81-0033TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

An experimental investigation of the flow field of an underexpanded rectangular jet issuing from a rectangular nozzle of aspect ratio 16.7 was undertaken. Tests were conducted for pressure ratios (settling chamber pressure/ambient pressure) ranging from 1.6 to 5.8. For pressure ratios greater than 1.9 the spectrum of the hot wire and microphone signals placed in the near field of the jet show discrete frequencies generally known as screech tones. At a pressure ratio of 3.7, Schlieren pictures show a distinct double wave pattern with their source being located at about 6 widths downstream. This results in an enhanced spreading of the jet as compared with other pressure ratios. A series of experiments on unconfined multiple jets has been performed for pressure ratios ranging from 1.6 to 3.7. Schlieren pictures were obtained which shows that the individual jets do not attract each other and mixing with the ambient air (or secondary air) takes place quite independently. The importance of sound waves (generated in one of the jets) acting upon the neighboring jets is demonstrated. Using this technique, it is shown that the mixing can be enhanced. GRA

N81-19419# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
CONFINED MIXING OF COAXIAL FLOWS
R. A. Tyler and R. G. Williamson Oct. 1980 72 p In ENGLISH; FRENCH summary
(AD-A095114; DME-LR-602; NRC-18831) Avail: NTIS HC A04/MF A01 CSCL 20/4

An empirical approach is used to correlate the mixing of isothermal incompressible coaxial air flows in straight pipes of constant circular cross-section. An assumed decay function for kinetic momentum is correlated in terms of initial geometry and initial velocities of the mixing streams. The method allows the rapid estimation of quantities of engineering interest including the axial distribution of both static pressure and total momentum. The method has been tested against published data on thrust augmenting ejectors of the parietal type, and found to provide satisfactory reproduction of measured performance as affected by mixing pipe length and area ratio. GRA

N81-19420# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FLOW CHARACTERISTICS IN A CHANNEL FOLLOWING EXIT OF INCIDENT SHOCK WAVE M.S. Thesis
Ralph H. Tate, III Dec. 1980 50 p refs
(AD-A094735; AFIT/GAE/AA/80D-20) Avail: NTIS HC A03/MF A01 CSCL 20/4

Dynamic variations in pressure occurring within shock tube channels following the exit of an incident shock wave were

investigated. Three channel sizes were investigated. The first size was 4 in by 8 in by 48 in the second size was 4 in by 1 in by 25 in, and the third size was 1 in by 1 in by 44 in. For the first and second channels, the shock tube diaphragm pressure ratio, P sub 41 ranged from 6.0 to 20.0. The third channel was used over a P sub 41 range of 8.0 to 20.0 and also to determine the presence of transverse waves due to an area reduction in the shock tube. The first channel, having the same cross-sectional area as the shock tube, exhibited pressures which approximated simple shock tube theory results. The second and third channels exhibited complex pressure changes which consistently peaked at the same time after the shock wave passed thr pressure sensors, independent of P sub 41. GRA

N81-19421# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TURBULENT SHEAR FLOW VELOCITY PROFILES BEHIND A GRID OF PARALLEL RODS OF VARIABLE SPACING M.S. Thesis

Thomas N. McKnight, Jr. Dec. 1980 100 p refs
(AD-A094776; AFIT/GAE/AA/80D-15) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental study was conducted to investigate the turbulent shear flow velocity profiles generated by a parallel-rod grid with adjustable spacing designed to produce an artificial boundary layer. The study was conducted in a low turbulence wind tunnel with a 9 x 9 x 37 inch test cabin. Data was collected using a hot-wire anemometer in conjunction with a correlator. The turbulence parameters reported are the development and distribution of mean velocities, fluctuating velocities, Reynolds stresses, microscales and integral scales at 32, 112, and 232 rod diameters downstream of the grid. Results show that stable power-law velocity profiles can be generated with negligible diffusion of the shear layer along the length of the test cabin. Turbulence intensity plots show that 75% of the grid generated turbulence decayed within 100 rod diameters downstream from the grid. The microscale and integral scales showed their minimum values close to the grid and increased in value downstream. Also, the ratio of the spatial integral scale to the spatial microscale was approximately 3.0 throughout the test cabin. GRA

N81-19422# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STUDY OF FREE CONVECTION IN AN INCLINED, RECTANGULAR CAVITY M.S. Thesis

Mohammad Khalid Khan Dec. 1980 108 p refs
(AD-A094759; AFIT/GAE/AA/80D-13) Avail: NTIS HC A06/MF A01 CSCL 20/13

A small experimental apparatus was designed for the measurement of heat flux across an enclosed, rectangular air cavity, which could be placed at any angle of inclination. The heat flux evaluation was done with the help of an interferometer. Heat flux was determined for five aspect ratios, each placed at four different angles and two different temperature differences for each setting. The average Nusselt number was found to be primarily a function of Grashof number or Rayleigh number. Three correlation equations developed by earlier studies are fitted to the data. The correlation equations are found to approximate the heat flux within + or - 11%, up to a Grashof number of 1.2 million. GRA

N81-19423# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.

COUPLEFLO: A COMPUTER PROGRAM FOR COUPLED CREEPING VISCOUS FLOW AND CONDUCTIVE-CONVECTIVE HEAT TRANSFER ADDENDUM

P. F. Chavez and P. R. Dawson Nov. 1980 45 p refs Prepared in cooperation with Cornell Univ., Ithaca, N.Y.
(Contract DE-AC04-76DP-000789)
(SAND-80-2566) Avail: NTIS HC A03/MF A01

COUPLEFLO, a two-dimensional finite element code for plane strain or axisymmetric analyses of thermomechanically coupled systems, is described. It is capable of analyzing the creeping flow of non-Newtonian fluids or the primary and secondary creep of solids. COUPLEFLO solves equations for conductive-convective heat transfer to determine the thermal response of a system. Thermomechanical coupling between the flow field and temperature distribution can exist in terms of temperature dependent material properties, temperature dependent body forces, viscous dissipation, material convection, and changing system geometry. Either transient or steady-state problems can be analyzed in Eulerian or quasi-Lagrangian reference frames. Improvements to the computer code are described. DOE

N81-19424# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.

NUMERICAL DETERMINATION OF FLUID VELOCITIES AND PRESSURE FOR A STEADY TWO DIMENSIONAL VISCOUS FLOW IN A CIRCULAR CAVITY

D. H. Feriss Sep. 1980 53 p refs
(NPL-DNACS-31/80) Avail: NTIS HC A04/MF A01

The steady motion of an incompressible viscous fluid in a plane circular cavity is expressed in terms of the fluid vorticity and a stream function. The governing partial differential equations are solved numerically using a hybrid upwind/central-difference scheme. The pressure distribution is subsequently calculated from a Poisson equation with Neumann boundary conditions and with a source term that can be expressed as the divergence of a vector quantity. Careful discretization of the Laplace operator and the source term is necessary to obtain a compatible set of finite difference equations that can be solved readily by successive over relaxation. Analysis of the compatibility requirements suggests a procedure for solving other Poisson-Neumann problems in which the presence of noise in the source terms would otherwise cause difficulties. Author (ESA)

N81-19425# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.

AUGMENTATION OF IN-TUBE CONDENSATION OF R-113 Final Technical Report

M. Luu and A. E. Bergles Jan. 1980 319 p refs Sponsored by the American Society of Heating, Refrigerating and Air-Conditioning Engineers
(PB81-120156; ISU-ERI-AMES-80175; HTL-23) Avail: NTIS HC A14/MF A01 CSCL 13A

A smooth tube, the smooth tube with twisted-tape inserts of two different pitches, three internally finned tubes, two tubes with repeated-rib roughness, and a spirally fluted tube were tested. The twisted-tape inserts increased overall average heat transfer coefficients approximately 30 percent above those of the smooth tube on a nominal area basis. The finned tube with the shortest and largest number of fins had the best performance, with heat transfer coefficients increased up to 120 percent. The repeated-rib tubes increased overall average heat transfer coefficients about 80 percent over the smooth tube values. Improvements in heat transfer coefficient for the spirally fluted tube were approximately 50 percent. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-19426* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CONTAINERLESS HIGH TEMPERATURE CALORIMETER APPARATUS Patents

Lewis L. Lacy and Daniel B. Nisen, inventors (to NASA) 3 Feb. 1981 6 p Filed 29 Jun. 1979 Supersedes N79-29492 (17 - 20, p 2677)
(NASA-Case-MFS-23923-1; US-Patent-4,248,083; US-Patent-Appl-SN-053569; US-Patent-Class-73-190R) Avail: US Patent and Trademark Office CSCL 14B

A calorimeter apparatus for measuring high temperature thermophysical properties of materials is disclosed which includes a containerless heating apparatus in which the specimen is

suspended and heated by electron bombardment.
Official Gazette of the U.S. Patent and Trademark Office

N81-19427* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SELF-CALIBRATING THRESHOLD DETECTOR Patent
James R. Barnes (TRW Systems Group, Redondo Beach, Calif.) and Marshall Y. Huang, inventors (to NASA) (TRW Systems Group, Redondo Beach, Calif.) Issued 23 Dec. 1980 7 p Filed 27 Jul. 1979 Supersedes N80-10413 (18 - 01, p 0057) Sponsored by NASA
(NASA-Case-MSC-16370-1; US-Patent-4,241,312; US-Patent-Appl-SN-061556; US-Patent-Class-329-50; US-Patent-Class-329-107; US-Patent-Class-375-1; US-Patent-Class-375-34; US-Patent-Class-375-99; US-Patent-Class-375-104) Avail: US Patent and Trademark Office CSCL 14B

A self calibrating threshold detector comprises a single demodulating channel which includes a mixer having one input receiving the incoming signal and another input receiving a local replica code. During a short time interval, an incorrect local code is applied to the mixer to incorrectly demodulate the incoming signal and to provide a reference level that calibrates the noise propagating through the channel. A sample and hold circuit is coupled to the channel for storing a sample of the reference level. During a relatively long time interval, the correct replica code provides an output level which ranges between the reference level and a maximum level that represents incoming signal presence and synchronism with the replica code. A summer substracts the stored sample reference from the output level to provide a resultant difference signal indicative of the acquisition of the expected signal.
Official Gazette of the U.S. Patent and Trademark Office

N81-19428*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A LOW ENERGY ELECTRON MAGNETOMETER Patent Application
Jag J. Singh, George M. Woods, Jr., Grayson Rayborn, H. (Univ. of Southern Mississippi, Hattiesburg), and Frederick A. White, inventors (to NASA) (Renssaelaer Polytechnic Inst.) Filed 26 Nov. 1980 18 p
(NASA-Case-LAR-12706-1; US-Patent-Appl-SN-210498) Avail: NTIS HC A02/MF A01 CSCL 14B

A low energy electron beam magnetometer is described that utilizes near monoenergetic electrons thereby reducing errors due to electron energy spread and electron nonuniform angular distribution. Atoms in an atomic beam of an inert gas are excited to a Rydberg state and then electrons of near zero energy are detached from the Rydberg atoms. The near zero energy electrons are then accelerated by an electric field to form the electron beam. In a second embodiment of the invention a filament emits electrons into an electrostatic analyzer which selects electrons at a predetermined energy level within a very narrow range. These selected electrons make up the electron beam that is subjected to the magnetic field being measured. Author

N81-19429*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FIXTURE FOR ENVIRONMENTAL EXPOSURE OF STRUCTURAL MATERIALS UNDER COMPRESSION Patent Application
Ronald K. Clark and W. Barry Lisagor, inventors (to NASA) Filed 26 Nov. 1980 11 p
(NASA-Case-LAR-12602-1; US-Patent-Appl-SN-210506) Avail: NTIS HC A02/MF A01 CSCL 14B

A device for stressing a deformable materials specimen consists of a top plate and a bottom plate sandwiching a guide cylinder. The specimen is positioned on the bottom plate and attached to a load piston. Force is applied through the top plate into the guide cylinder. Once the specimen is been loaded, the stress is maintained by tightening tie bolt nuts. NASA

N81-19430*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTRUSION DETECTION METHOD AND APPARATUS Patent Application
Robert D. Lee, inventor (to NASA) Filed 28 Jan. 1981 15 p
(NASA-Case-ARC-11317-1; US-Patent-Appl-SN-229231) Avail: NTIS HC A02/MF A01 CSCL 14B

A system for monitoring unwanted subterranean entries and departures from a secure and for locating and intrusion includes an array of seismic sensors arranged along a perimeter to be monitored. Two wires lead from each sensor to a central monitoring station which has three modes of operation. In the first mode, the output of all the seismic sensors is summed into a receiver for amplification and detection. In the second mode, the individual output signals from the sensors are multiplexed into the receiver via scanner and gates for sequentially interrogating each of the sensors. The third operating mode permits the operator to manually scan up and down the individual sensors. In this manner a more precise location of the intrusion is obtained. An automatic gain control is provided for the receiver allowing the sensitivity of the receiver to be automatically adjusted for optimum sensitivity with changes in background noise level.
NASA

N81-19431*# Battelle Columbus Labs., Ohio.
AN INVESTIGATION OF SELF-SUBTRACTION HOLOGRAPHY IN LiNbO3 Final Report
D. W. Vahey, R. P. Kenan, N. F. Hartman, and R. C. Sherman Mar. 1981 80 p refs
(Contract NAS1-15736)
(NASA-CR-159336) Avail: NTIS HC A05/MF A01 CSCL 14E

A sample having self subtraction characteristics that were very promising was tested in depth: hologram formation times were on the order of 150 sec, the null signal was less than 2.5% of the peak signal, and no fatigue nor instability was detected over the span of the experiments. Another sample, fabricated with, at most, slight modifications did not perform nearly as well. In all samples, attempts to improve self subtraction characteristics by various thermal treatments had no effects or adverse effects, with one exception in which improvement was noted after a time delay of several days. A theory developed to describe self subtraction showed the observed decrease in beam intensity with time, but the shape of the predicted decay curve was oscillatory in contrast to the exponential like decay observed. The theory was also inadequate to account for the experimental sensitivity of self subtraction to the Bragg angle of the hologram. It is concluded that self subtraction is a viable method for optical processing systems requiring background discrimination. E.D.K.

N81-19432# Arizona Univ., Tucson. Optical Sciences Center.
IMAGE PROCESSING Final Report
B. Roy Frieden Feb. 1981 11 p refs
(Grants DAAG29-77-G-0182; DAAG29-79-G-0041; DAAG29-76-G-0283)
(AD-A095075; ARO-13836.4-EL; ARO-16018.2-EL) HC A02/MF A01 CSCL 14/5

This report is a synopsis of work performed under ARO auspices during 1976-1980 on problems in image processing. The main problem areas under investigation were image restoration, image smoothing and the missing phase problem of speckle interferometry. Three algorithms were developed to attack these problems: the median window restoring method, the maximum entropy restoring method, and the maximum information restoring method. Additional algorithms were developed for estimating point spread functions, for finding the optical pupil that relays a maximum of object information to the image, and for analyzing the signal-dependent properties of noise in White Sands Missile Range vidicon system. GRA

N81-19433# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.
IMAGING THROUGH SCATTERING MEDIA WITH GRATING-BASED INTERFEROMETERS Final Report, 1 Aug. 1979 - 31 Oct. 1981
Anthony M. Tai and Carl C. Aleksoff Dec. 1980 27 p refs
(Contract DAAG29-79-C-0143)
(AD-A095098; ERIM-143900-8-F; ARO-16226.5-EL) Avail: NTIS HC A03/MF A01 CSCL 14/5

In this report, the problem of imaging through scattering media is described and the basic approaches to the problem are reviewed. The concept of grating-based interferometers is

introduced and some possible configurations are presented. The applications of the grating interferometers in imaging through scattering media are analyzed. The interferometers are basically utilized as coherence discriminators, separating out the scattered components of the received light fields by their coherence properties. The imaging of targets under both monochromatic and wideband illuminations are considered. Experimental results are provided to demonstrate the effectiveness of the concept. GRA

N81-19434# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
SPIN PIT APPLICATION OF IMAGE DEROTATED HOLOGRAPHIC INTERFEROMETRY Final Report, 22 Oct. 1979 - 15 Sep. 1980
J. L. Bearden and J. F. Clarady Sep. 1980 52 p refs
(Contract F33615-79-C-2071; AF Proj. 3066)
(AD-A095030; PWA-FR-13041; AFWAL-TR-80-2083) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes the results of a program in which an experimental technique for image derotated holographic interferometry was developed to investigate the resonant response of a gas turbine engine bladed-disk assembly under controlled laboratory conditions of rotation and vibratory excitation. Image derotated holograms were taken for several modes of vibration of a rotating bladed disk at speeds up to 7,500 rpm in a laboratory spin test facility. GRA

N81-19435# Army Armament Research and Development Command, Dover, N. J. Product Assurance Directorate.
AXIS: A COMPUTER'S EYE VIEW OF AN X-RAY Interim Report
Joseph M. Argento Jan. 1981 24 p
(AD-A094753; AD-E400541; ARPAD-TR-80001) Avail: NTIS HC A02/MF A01 CSCL 14/5

Human subjectivity and fatigue have long been a problem in X-ray interpretation. AXIS is a program to remove these problems from X-ray reading. To accomplish this, the process of film reading is being automated. X-ray radiographs of actual shell are being analyzed and from this analysis computer algorithms are being developed to characterize both the digital image of the shell and anomalous points on the shell image. The system will be installed in an ammunition plant and will be used as the film interpreter in an actual munition line. To keep up with production, ingenious use is being made of a device called an array processor. This device allows many computer operations to be accomplished simultaneously. The array processor will permit analysis of the radiographic image in about ten seconds. This report describes the basic techniques used to analyze a radiograph and also some of the equipment that will be used in the final system. GRA

N81-19436# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A GAS FLOW TUBE FOR SPECTROSCOPIC STUDIES M.S. Thesis
Vernon Raymond Koym Dec. 1980 107 p refs
(AD-A094964; AFIT/GEP/PH/80D-5) Avail: NTIS HC A06/MF A01 CSCL 07/4

A gas flow tube was constructed to allow chemical reaction studies at pressures from 0.1 torr to 30 torr. The tube was designed to allow introduction of oxidants, diluents, or excited gases. A furnace was constructed to produce high temperature vapor in the combustion chamber of the flow tube. The flow tube was characterized by its pumping speed, pressure, throughput, and evaluating Reynolds and Knudsens numbers at pressures from 0.1 - 20 torr. Two experiments were conducted to verify the flow tube performance. Singlet molecular oxygen was produced in a microwave discharge and reacted with gaseous I2 to yield chemiluminescence from the transition I2(B) yields I2(X). The spectrum was recorded and the bandheads assigned to vibrational transitions predicted by theory. PbO was created by reacting vaporized lead with N2O. The emissions were compared with literature. GRA

N81-19437# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
A LOW INERTIA, SONIC THERMOMETER FOR BALLOON PURPOSES
M. Friedrich Jan. 1979 16 p refs
(Grant ACSR-2786/S)
(INW-7902) Avail: NTIS HC A02/MF A01

A continuous wave-type sonic thermometer measuring the phase between emitted and received signal of a known frequency is described. Design characteristics and details of the circuits are given for the instrument, which may be used for detecting short term pressure variations from balloon platforms up to 38 km. Data from an August high latitude balloon flight are shown. Author (ESA)

N81-19438# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
A FAST, HIGH RESOLUTION CAPACITANCE PROBE
M. Friedrich Dec. 1979 19 p refs Sponsored by Austrian Council for Scientific Research, Austrian Academy of Sciences, Academy of Science (USSR)
(INW-7911) Avail: NTIS HC A02/MF A01

A spherical fixed frequency impedance probe is described. The probe was developed for atmospheric plasma measurements from sounding rockets subjected to short-lived small perturbations created by an electron guns. One test mission is described, and the preliminary profile of the measured natural electron density is given. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-19439*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIDELOOKING LASER ALTIMETER FOR A FLIGHT SIMULATOR Patent Application
Larry D. Webster, inventor (to NASA) Filed 13 Feb. 1981 29 p
(NASA-Case-ARC-11312-1; US-Patent-Appl-SN-234244) Avail: NTIS HC A03/MF A01 CSCL 20E

A laser altimeter for a flight simulator which allows measurement of the height of the simulator probe above the terrain directly below the probe tip is disclosed. A laser beam is directed from the probe at an angle to the horizontal to produce a beam spot on the terrain. The angle that the laser beam makes with the horizontal is varied so as to bring the beam spot into coincidence with a plumb line coaxial with the longitudinal axis of the probe. A television altimeter camera observes the beam spot and has a raster line aligned with the plumb line. Spot detector circuit coupled to the output of the TV camera monitors the position of the beam spot relative to the plumb line. An error signal is produced by computer driving, via a servo motor, the laser beam optics so as to cause the beam spot coincidence with the plumb line. At coincidence, computer looks up in a table the altitude of the probe for the given angle and reads out the altitude to an altimeter readout. Author

N81-19440*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DUAL LASER OPTICAL SYSTEM AND METHOD FOR STUDYING FLUID FLOW Patent Application
Robert B. Owen and William K. Witherow, inventors (to NASA) Filed 12 Jan. 1981 9 p
(NASA-Case-MFS-25315-1; US-Patent-Appl-SN-224232) Avail: NTIS HC A02/MF A01 CSCL 20E

A dual laser optical system and method is disclosed for visualization of phenomena in transparent substances which induce refractive index gradients such as fluid flow and pressure and temperature gradients in fluids and gases. Two images representing mutually perpendicular components of refractive index gradients are viewed simultaneously on screen. Two lasers having wave lengths in the visible range but separated by about 1000 angstroms are utilized to provide beams which are collimated into a beam containing components of the different wave lengths. The collimated beam is passed through a test volume of the transparent substance. The collimated beam is then separated into components of the different wave lengths

and focused on to a pair of knife edges arranged mutually perpendicular to produce and project images onto screen.Author

N81-19441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEST TECHNIQUES FOR DETERMINING LASER RANGING SYSTEM PERFORMANCE
Thomas W. Zagwodzki Jan. 1981 24 p refs
(NASA-TM-82061) Avail: NTIS HC A02/MF A01 CSCL 20E

Procedures and results of an on going test program intended to evaluate laser ranging system performance levels in the field as well as in the laboratory are summarized. Tests show that laser ranging system design requires consideration of time biases and RMS jitters of individual system components. All simple Q switched lasers tested were found to be inadequate for 10 centimeter ranging systems. Timing discriminators operating over a typical 100:1 dynamic signal range may introduce as much as 7 to 9 centimeters of range bias. Time interval units commercially available today are capable of half centimeter performance and are adequate for all field systems currently deployed. Photomultipliers tested show typical tube time biases of one centimeter with single photoelectron transit time jitter of approximately 10 centimeters. Test results demonstrate that NASA's Mobile Laser Ranging System (MOBLAS) receiver configuration is limiting system performance below the 100 photoelectron level. E.D.K.

N81-19442# Avco-Everett Research Lab., Mass.
ANALYSIS OF ULTRAVIOLET AND VISIBLE LASER EFFECTS Final Technical Report, 20 Aug. - 15 Nov. 1980
C. Duzy, C. J. Knight, J. A. Woodroffe, and L. A. Young Jan. 1981 72 p refs
(Contract DAAH01-80-C-1523; DARPA Order 3643)
(AD-A094787) Avail: NTIS HC A04/MF A01 CSCL 20/5

In extrapolating UV/visible effects data obtained with small spots to large spots, it is essential to determine the dominant mechanisms. In this report we present analytical results on the dominant effects at high fluence, vaporization of the surface and plasma formation. Under vacuum conditions with an aluminum surface and about microsecond pulses, we find the impulse coupling coefficient due to vapor recoil to be about 3 for XeF and about 6 for KrF at high fluences. The plasma threshold is greater than 25 MW sq cm incident flux and less than 100 sq cm; the exact value depends on assumptions regarding rate constants. GRA

N81-19443# Defence Research Establishment Valcartier (Quebec).
FOCUSED LASER BEAMS IN TURBULENT MEDIA
L. R. Bissonnette Dec. 1980 48 p refs In ENGLISH; FRENCH summary
(AD-A095079; DREV-R-4178/80) Avail: NTIS HC A03/MF A01 CSCL 20/5

A closed set of three simultaneous partial differential equations is derived for the solution of the average irradiance and the irradiance variance of focused laser beams in a turbulent medium. The equations are uniformly valid for arbitrary scintillation levels. Examples of solutions calculated by finite difference techniques agree very well with experimental data in the atmosphere and in the laboratory. An analytic expression for the turbulence induced beam spreading is obtained and shown to be more precise than the commonly used formula based on the coherence diameter rho sub 0. In the weak scintillation limit, the irradiance variance solution agrees with the classical perturbation results. GRA

N81-19444# Michigan Univ., Ann Arbor. College of Engineering.
THEORETICAL STUDIES OF LASER LIGHT INTERACTION AND OPTICAL AND X-RAY EMISSION FROM DENSE METALLIC PLASMAS Final Report, 1 Oct. 1979 - 1 Oct. 1980
J. J. Duderstadt, R. S. B. Ong, J. P. Sheerin, A. Schmitt, S. Freije, and R. Cauble Nov. 1980 25 p refs
(Contract AF-AFOSR-0029-80; AF Proj. 2301)
(AD-A094664; AFOSR-81-0075TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

The behavior of the pulse of a high intensity laser beam is investigated as the beam penetrates into a low temperature high density plasma. Given the physical characteristics of the target plasma a study is made of the evolution of the incident laser pulse as it propagates through the plasma. A study is made of the dynamics of the strongly turbulent plasma generated by the interaction of an intense laser beam and the background plasma. The strongly turbulent plasma can be viewed as a collection of localized highly nonlinear electric field structures (solitons). The behavior of a laser heated aluminum exploding wire plasma is investigated by means of a radiation transport model for line radiation. MHD computer codes with nonequilibrium ionization dynamics are developed for the analysis. The physics of a strongly coupled plasma is studied via an appropriate kinetic model. The dynamic structure factor which enables one to interpret the scattered light from the plasma due to laser radiation is obtained. This is a very essential tool for diagnostics of such strongly coupled plasmas. GRA

N81-19445*# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
MEASUREMENT OF FUEL SPRAY VAPORIZATION BY LASER TECHNIQUES Interim Report
A. J. Yule, C. Ah. Seng, P. G. Felton, A. Ungut, and N. A. Chigier Sep. 1980 10 p refs Presented at the Symp. on Long Range and Short Range Optical Velocity Measurements, Saint Louis, 15-18 Sep. 1980
(Grants NsG-7517; AF-AFOSR-3414-77; AF Proj. 2308)
(AD-A094789; AFOSR-81-0092TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Comparison of fuel spray structures in heated and in cold environments was made by using a new laser tomographic technique and laser anemometry. The tomography technique is shown to give accurate and rapid 'point' measurements of droplet sizes and concentrations. Experimental results show acceleration of droplets to the local gas velocity, preferential vaporization of the smallest droplets and the dispersion of droplets by the turbulence. GRA

N81-19446# Washington State Univ., Pullman. Dept. of Physics.
INTERACTION OF INTENSE INFRARED LASER BEAMS WITH TRANSPARENT SOLIDS Final Report, 1 Aug. 1978 - 30 Sep. 1980
P. Braunlich, Garnett Bryant, A. Schmid, and P. Kelly (National Research Council, Ottawa, Canada) 1 Dec. 1980 78 p refs
(Contract F49620-78-C-0095; AF Proj. 2306)
(AD-A094803; AFOSR-81-0030TR) Avail: NTIS HC A05/MF A01 CSCL 20/5

In order to investigate beam deformation and depletion at very high photon fluxes, a computational procedure was developed that is suitable to simulate the propagation of intense beams through transparent solids. It was applied to NaCl exposed to a FWHM 21 psec pulse from a frequency-doubled 0.532 micron Nd-YAG laser. The energy content of this TEM sub-(zero-zero)-mode pulse is equal to the experimentally determined single-shot damage threshold of this material. The most convenient mode of data display was found to be a motion picture showing the propagation of the pulse, represented as a colored contour map of the local photon flux, through the focal region. Similar displays of the spatio-temporal development of the free carrier concentration have been made. GRA

N81-19447# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
RETURN WAVE ANALYSIS IN A THERMALLY BLOOMED MEDIUM M.S. Thesis
Michael Thomas Baker Dec. 1980 67 p refs
(AD-A094721; AFIT/GEO/PH/80D-2) Avail: NTIS HC A04/MF A01 CSCL 04/1

A computer code was developed to perform a geometrical ray trace of a light ray from a target plane to a receiver plane via a thermally bloomed medium. Thermal blooming was modeled using a computer code from the Air Force Weapons Laboratory called PROPMD. Ray traces were done for various degrees of thermal blooming, and Strehl ratios were made for each situation. Also, contour plots of the ray optical path deviations across the receiver plane were made. Results showed that a ray's direction of propagation was virtually unaffected by refraction. Disturbance

of the ray was due totally to the effect of thermal blooming on the optical path length of the ray. In severe blooming situations, calculated Strehl ratios were less than 0.1. However, limiting the size of the high-energy beam grid led to improved Strehl ratios. GRA

N81-19448# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANALYSIS OF MODES IN AN UNSTABLE STRIP LASER RESONATOR M.S. Thesis

James E. Rowley Dec. 1980 156 p refs
(AD-A094722; AFIT/GEP/PH/80D-7) Avail: NTIS HC A08/MF A01 CSCL 20/5

The mode eigenvalue equation for an unstable strip laser resonator is developed from scalar diffraction theory. The field distributions are expressed as a series and the integral is then evaluated using a first order approximation to the method of stationary phase. The resulting approximate closed form is rearranged to form an eigenvalue polynomial, the roots of which are the mode eigenvalues. Eigenfunction expressions are then developed using second order approximation to the method of stationary phase. Modifications to these expressions are then made to account for the presence of uniform gain in the resonator. The results of a computer program using the derived expressions are presented. Comparisons to previously published results are made for the bare cavity case, and results for the loaded cavity case follow. GRA

N81-19449# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

INCOHERENT AND LASER PHOTODEPOSITION ON THIN FILMS M.S. Thesis

Walter E. Johnson Sep. 1980 86 p refs
(AD-A094718; AFIT/GEP/PH/80D-3) Avail: NTIS HC A05/MF A01 CSCL 11/3

High purity Zn, Se, and ZnSe thin films (approximately 100 to 6000A thicknesses) have been deposited on both quartz and sapphire substrates by using a Hg arc lamp u-v light source to photodissociate the organometallic molecules Zn(CH3)2 and Se(CH3)2. Large area depositions (approximately 1.5 cm diameter circles) have been produced, along with masked depositions created by selectively blocking the incoherent light source. Absorption measurements of these organometallic vapors from 0.2 to 20 microns indicates the possibility of producing ultra-high purity thin films by using simultaneously both a CO (5.6 - 5.9 micron) and a CO2 (10.6 micron) laser in conjunction with a pulsed KrF (2480A) in a highly selective two step photodissociation process. Such results offer the potential for a drastically new and greatly improved quality film plus an extremely well controlled alternative to the more conventional thin film deposition techniques such as thermal vacuum deposition, sputtering, and chemical vapor deposition. GRA

N81-19450# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TRADE-OFF ANALYSIS OF WAVELENGTHS FOR TACTICAL ELECTRO-OPTICAL AIR-TO-GROUND WEAPON SYSTEMS M.S. Thesis

Gregory A. Mullins Dec. 1980 80 p refs
(AD-A094813; AFIT/GEO/PH/80D-9) Avail: NTIS HC A05/MF A01 CSCL 15/3

A trade-off analysis was conducted for Nd:YAG, CO2, and millimeter wave (90 GHz) systems to determine which has the greatest potential for the next generation, electro-optical tactical weapon system for the Air Force. State-of-the-art performance parameters were used for each of the candidate systems. Also, inherent wavelength-dependent factors were established by the selection of the Eastern European scenario as the theoretical engagement theater. By using utility theory, trade-off analysis was performed on the basis of individual system figures-of-merit. The analysis showed that, for the air-to-ground delivery of point-tracking weapons, the CO2 system has the highest utility, followed by the Nd:YAG system. The millimeter wave system exhibits very poor utility because of its large beam divergence. GRA

N81-19451# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

HELBASE: A TOOL FOR THE ANALYSIS OF HIGH ENERGY LASER WEAPON DEVELOPMENT, DEPLOYMENT, AND OPERATION M.S. Thesis

Jeffrey L. Dutton Dec. 1980 187 p refs
(AD-A094854; AFIT/GOR/OS-80D-3) Avail: NTIS HC A09/MF A02 CSCL 15/3

A computerized simulation model was developed as a flexible tool to aid in the design, deployment, and employment decisions regarding high energy laser weapons. Only the 'space defensive' and 'antisatellite' missions are considered. The simulation models the physical processes of laser propagation and laser effects, and it includes a 'first-order' optimization process for selection of weapons and weapon paths of maximum efficiency. It also includes a 'many-on-many' engagement model to test the effectiveness of the weapons selected. Target satellites include a set of four hypothetical systems representing 'real world' possibilities. Weapon choices may be based on the surface of the earth, in aircraft, or in circular orbits. The user specifies weapon design characteristics as well as associated basing modes for each type of weapon to be deployed by the optimization model. In addition to selecting the targets and defining the types of weapons to be used, the user defines the time allowed to accomplish a defined mission, and the percentage of each system of target satellites which must be negated. Rudimentary tactics for weapon employment are also allowed. Validation, verification, and experimental designs for model use are discussed. Recommendations for model expansion are given. GRA

N81-19452# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

IODINE DISSOCIATION IN A SHOCK TUBE M.S. Thesis

Lawrence C. Farnell Dec. 1980 60 p refs
(AD-A094760; AFIT/GAE/AA/80D-5) Avail: NTIS HC A04/MF A01 CSCL 20/5

A two-in. (5.08 cm) I.D. circular shock tube was assembled to study the dissociation of iodine. This study was an initial investigation into the possible use of shock waves to dissociate iodine in an electronically excited state. Iodine has an emission transition in this state at a wavelength of 1,315 micron which is used in the iodine laser. Using argon as the diluent gas, tests were observed with an indium-antimonide detector to determine if emissions in the 1.1 to 5.5 micron range of the detector were present. Tests with and without iodine were conducted at a Mach number of approximately 2.5 with reflected shock wave temperature of about 1570 K. comparison of these tests indicates that a significant infrared emission from iodine was present in the detector range. The presence of the 1.315 micron transition cannot yet be confirmed in that three iodine transitions exist in the given range, other emissions from unknown sources could be present, and the detector bandwidth could not be suitably narrowed. Further research is required to specifically identify the spectrum of IR present. GRA

N81-19453# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Physics.

MOBILE LIDAR SYSTEM FOR ENVIRONMENTAL PROBING

K. Fredriksson, B. Galle, K. Nystroem, and S. Svanberg Nov. 1979 18 p refs
Avail: NTIS HC A02/MF A01

A fully mobile remote sensing unit, based on the lidar principle, is described. Information on atmospheric pollutants or general atmospheric parameters can be obtained using scattering, differential absorption, or Raman techniques. Hydrospheric probing can be performed based on laser induced fluorescence or elastic back-scattering. The system incorporates a powerful Nd:YAG Laser whose beam is directed toward the measuring volume by a flat mirror. The system platform is a 3500 kg covered truck with a trailer carrying two 5 kW motor generators. Examples of performed environmental measurements are given. Author (ESA)

N81-19454# Siemens A.G., Munich (West Germany). Forschungslab.

LASER DIODE Final Report

Klaus Heinz Mettler, Hans-Dietrich Wolf, Dieter Pawlik, and Hans Meixner Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 102 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-138; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21,45

Development of semiconductor injection lasers of the type used as light sources in fiber optic systems is described. In order to improve reliability and increase service life, the fabrication of GaAl as double heterostructures diode lasers is proposed. The necessary fabrication steps and the methods of characterization for the lasers are outlined. How operating degradation can be decreased through the reduction of the effect of oxygen in the epitaxial process, the use of substrates of low dislocation densities, and by coating the laser mirrors with aluminum oxide is shown. As a result, the critical limit at which mirror damage occurs is increased to an optical power density of up to 8 mW per micron strip width. In degradation tests, selected diodes give an optical output power of up to 10 mW for periods of up to 6000 hours and of 2 mW over more than 10,000 hours. Nevertheless, the very low yield of long live injection lasers remains problematical. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-19455* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

METHOD OF COLD WELDING USING ION BEAM TECHNOLOGY Patent

Bernard L. Sater, inventor (to NASA) Issued 20 Jan. 1981 5 p Filed 28 Jul. 1978 Supersedes N78-28459 (16 - 19, p 2534)

(NASA-Case-LEW-12982-1; US-Patent-4,245,768; US-Patent-Appl-SN-929084; US-Patent-Class-228-116; US-Patent-Class-228-205; US-Patent-Class-204-192E) Avail: US Patent and Trademark Office CSCL 13H

A method for cold welding metal joints is described. In order to remove the contamination layer on the surface of the metal, an ion beam generator is used in a vacuum environment. A gas, such as xenon or argon, is ionized and accelerated toward the metal surface. The beam of gas effectively sputters away the surface oxides and contamination layer so that clean underlying metal is exposed in the area to be welded. The use of this method allows cold welding with minimal deformation. Both similar and dissimilar metals can be cold welded with this method.Official Gazette of the U.S. Patent and Trademark Office

N81-19456 Iowa State Univ. of Science and Technology, Ames.

DESIGN OF TURBINE CASCADES WITH TRANSITIONAL PROFILE BOUNDARY LAYERS Ph.D. Thesis

Gabriel Acacio Alarcon 1980 250 p

Avail: Univ. Microfilms Order No. 8103427

A computer based 'direct' design system for two dimensional turbine airfoils in cascade involves a sequence of calculation in which the airfoil profile is arbitrarily designed from velocity diagram requirements and inviscid blade-to-blade flow calculation of the velocity distribution and the exit angle is made. A transitional boundary layer analysis is then carried out followed by a wake mixing analysis to calculate profile losses and the viscous exit gas angle. The profile design can be rapidly iterated on through adjustment of a number of geometry parameters and the flow analysis repeated until a design is found yielding the lowest profile losses. The inviscid-viscous calculation method developed yields results for total pressure loss and exit gas angle which agree well with experimental cascade data. Dissert. Abstr.

N81-19457*# National Aeronautics and Space Administration. Pasadena Office, Calif.

ANTENNA GROUT REPLACEMENT SYSTEM Patent Application

Charles E. McClung, inventor (to NASA) (JPL) Filed 10 Feb. 1981 16 p

(Contract NAS7-100)

(NASA-Case-NPO-15205-1; US-Patent-Appl-SN-233271) Avail: NTIS HC A02/MF A01 CSCL 13I

An epoxy grout suitable for use in mounting and positioning bearing runner plates used in hydrostatic bearing assemblies for rotatably mounting large radio telescopes structures to stationary support pedestals is described. The epoxy grout may be used in original mountings or may be used as part of a replacement system for repairing cavities in existing grout resulting from grout deterioration. The epoxy grout has a relatively short work life and cure time even in the presence of hydraulic oil. The epoxy grout cures without shrinking or sagging to form a grout which is sufficiently strong and durable to provide a grout especially well suited for use under the high pressure loading and close tolerance requirements of large hydrostatic bearing assemblies. Author

N81-19458*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF JET- AND INNER-RING-LUBRICATED 35 MILLIMETER BORE BALL BEARINGS OPERATING TO 2.5 MILLION DN

Fredrick Schuller, T. and Hans R. Signer Feb. 1981 15 p refs

(NASA-TP-1808; E-515) Avail: NTIS HC A02/MF A01 CSCL 13I

Parametric tests were conducted with a 35 millimeter bore, angular contact ball bearing having a single outer land guided cage. Lubrication was achieved by flowing oil through axial grooves and radial holes machined in the inner ring of the bearing. Test conditions were a thrust load of 667 N (150 lb), shaft speeds from 48,000 to 72,000 rpm, and an oil inlet temperature of 394 K (250 F). Data from tests where the distribution of the total oil supplied to the inner ring was 50 percent for bearing lubrication and 50 percent for bearing inner ring cooling were compared with those where the distribution pattern was 25 percent lubrication and 75 percent cooling. Successful operation was experienced with both the 50-50 and 25-75 percent flow distribution patterns to 2.5 million DN. The 50-50 percent flow pattern provided the cooler bearing operation of the two inner ring lubricated bearings. The jet lubricated bearing had lower outer ring and higher inner ring temperatures than the inner ring lubricated bearings. Maximum power loss of 2.8 kW (3.7 hp) was experienced with the 25-75 percent flow distribution, and maximum percent cage slip of 7.0 occurred at 72,300 rpm with the 50-50 percent flow distribution. Author

N81-19459*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCED CONTINUOUSLY VARIABLE TRANSMISSIONS FOR ELECTRIC AND HYBRID VEHICLES

Stuart H. Loewenthal 1980 29 p refs Presented at Electric and Hybrid Vehicle Advanced Vehicle Seminar, Pasadena, Calif., 8-9 Dec. 1980

(Contract DE-AI01-77CS-51044)

(NASA-TM-81718; DOE/NASA/51044-17; E-752) Avail: NTIS HC A03/MF A01 CSCL 13F

A brief survey of past and present continuously variable transmissions (CVT) which are potentially suitable for application with electric and hybrid vehicles is presented. Discussion of general transmission requirements and benefits attainable with a CVT for electric vehicle use is given. The arrangement and function of several specific CVT concepts are cited along with their current development status. Lastly, the results of preliminary design studies conducted under a NASA contract for DOE on four CVT concepts for use in advanced electric vehicles are reviewed. Author

N81-19460# Shaker Research Corp., Ballston Lake, N. Y.

ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 8: A COMPUTERIZED DATA RETRIEVAL SYSTEM FOR FLUID FILM BEARINGS Interim Report, Mar. 1979 - Mar. 1980

C. H. T. Pan, B. F. Geren, J. A. Bartlett, and S. Fielder Wright-Patterson AFB, Ohio AFWAL Oct. 1980 250 p refs (Contract F33615-76-C-2038; AF Proj. 3048)

(AD-A094087; SRC-79-TR-46; AFAPL-TR-78-6-PT-8) Avail: NTIS HC A11/MF A01 CSCL 13/9

This report describes a computerized data storage retrieval system for the static and dynamic characteristics of fluid film bearings. The procedure combines asymptotic power law

extrapolation outside the stored data range with smooth interpolation within the data table. Thirty-one data tables have been prepared and installed in the system. The procedure allows addition of new data tables in the future. The retrieval software allows the user to list the data content in either the dimensional or the dimensionless form or to generate data lines in the sequence and format directly usable as input to the rotordynamics software described. Inertia, compliance and damping effects of the pedestal can be included in the retrieval dynamic characteristics of each bearing. GRA

N81-19461# Cairo Univ. (Egypt). Center for Combustion.
SPRAY MODELING FOR MULTIFUEL ENGINES Annual Technical Report, Mar. 1979 - Apr. 1980
M. M. Elkotb Jul. 1980 78 p refs
(Grant DA-ERO-79-G-0017; DA Proj. 1T1-61102-BH-577)
(AD-A095110; ATR-1) Avail: NTIS HC A05//MF A01 CSCL 21/5

The present project deals with the fuel spray modelling in multifuel engines using the droplet behaviour approach. The multifuel engine is able to burn different types of fuel having various physical and chemical properties, either clear or mixture with arbitrary mixing ratio. Analysis of the physical and chemical properties affecting mixture creation and combustion have been carried out to define the parameters affecting the accuracy of spray modelling. It is found that the spray is affected by air flow field, heat transfer, fuel atomization, droplet behaviour, fuel evaporation and chemical kinetics. Solution of the flow field and experimental results of heat transfer have been obtained. Experiments were performed in a set up that allowed variation of the swirl chamber geometry and operating conditions to evaluate the instantaneous surface heat transfer under firing conditions. The instantaneous heat flux was determined taking into consideration the instantaneous composition of products and variation of specific heats. A generalized expression has been established for the calculation of heat transfer to the chamber wall under variable design and operating conditions. GRA

N81-19462# ARO, Inc., Arnold Air Force Station, Tenn.
MEASUREMENTS OF TEMPERATURE AND N2 NUMBER DENSITY IN THE COMBUSTION CYLINDER OF A CI ENGINE UTILIZING LASER-RAMAN DIAGNOSTICS Final Report, 24 Feb. - 1 Oct. 1980
W. D. Williams, J. W. Lewis, and J. H. Jones AEDC Jan. 1981 46 p refs Sponsored by Air Force
(AD-A094221; AEDC-TR-80-55) Avail: NTIS HC A03/MF A01 CSCL 21/5

Laser-Raman scattering has been used to measure temperature and nitrogen number density in the combustion cylinder of a specialized research CI engine. Measurements were made as a function of crank angle degrees (CAD) for unfueled operation at 500 and 1,000 rpm and for operation at 1,000 rpm using n-heptane as an alternate fuel to diesel fuel no. 2. A pulsed ruby laser system was the excitation source for the Raman scattering, and the CAD resolution of the measurements was .0015 to 0.36 degrees. GRA

N81-19463# Argonne National Lab., Ill. Energy and Environmental Systems Div.
CLASSIFICATION AND EVALUATION OF ELECTRIC MOTORS AND PUMPS
Sep. 1980 267 p refs Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, Mass. and Energy and Environmental Analysis, Inc., Arlington, Va.
(Contract W-31-109-eng-38)
(DOE/TIC-11339) Avail: NTIS HC A12/MF A01

Electric motors and pumps are evaluated to determine standard classifications with respect to size, function, type of energy used, method of manufacture, and the practicability and effects of requiring all or part of such classes of electric motors and pumps to meet performance standards establishing minimum levels of energy efficiency. Two specific conservation strategies for improving the energy efficiency of standardized electric motors and pumps are analyzed: labeling rules; and energy efficiency standards. DOE

N81-19464# Department of Energy, Washington, D. C. Office of Transportation Programs.
AUTOMOTIVE TECHNOLOGY DEVELOPMENT PROGRAM Annual Report to Congress, 30 Sep. 1980
30 Sep. 1980 30 p
(DOE/CS-0069/1; AR-2) Avail: NTIS HC A03/MF A01

Advanced gas turbine (AGT) engines, advanced Stirling engines (ASE), vehicles and vehicle components to use with advanced, energy conserving automotive propulsion systems are described. For the AGT, accomplishments included: awarded contracts for AGT development; completed reference powertrain design; initiated design and fabrication of testing facilities; and testing of components. For the ASE, components were tested up to 4000 h. A turbocompound diesel engine completed 54,000 miles of road testing and showed a 5 percent fuel economy improvement. Ten thousand miles of road testing a prototype Diesel Organic Rankine Bottoming Cycle in a heavy truck engine showed a 10 percent fuel economy gain. Three hundred standard GSA vehicles, operated with a Controlled Speed Accessory Drive showed, a 6 to 8 percent fuel economy gain. DOE

N81-19465# Alberta Univ., Edmonton.
ENHANCED IGNITION FOR I.C. ENGINES WITH PREMIXED CHARGE
J. D. Dale (Alberta Univ., Canada) and A. K. Oppenheim Oct. 1980 48 p refs Presented at the Soc. of Automotive Engr. Intern. Eng. Congr. and Exposition, Detroit, 23 Feb. 1981
(Contract W-7405-eng-48)
(LBL-11880; CONF-810206-3) Avail: NTIS HC A03/MF A01

Enhanced ignition involves a wide dispersion of its sources so that combustion is carried out at as many sites throughout the charge as possible. Various ignition systems internal combustion (I.C) engines, operating with premixed charge, are reviewed. The systems are grouped within the following categories: (1) high energy spark plugs; (2) plasma jet igniters; (3) photochemical, laser, and microwave ignition concepts; (4) torch cells; (5) divided chamber stratified engines; (6) flame jet igniters; (7) combustion jet ignition concepts (8) exhaust gas recirculation (EGR) ignition system. The concept of staging the processes of initiation and progation of combustion is emphasized. Relative positions of various ignition systems are expressed on the plane of relative energies and relative volumes. In principle, ignition systems for engines operating with premixed charge lie on the half-plane of relative energies below one, between 10(-5) for standard spark plugs to 10(-1) for divided chamber stratified charge engines, while their relative volumes extend from 0 for spark igniters to 0.2 for stratified charge engines. DOE

N81-19466# United Technologies Corp., South Windsor, Conn. Power Systems Div.
HIGH-RELIABILITY GAS TURBINE COMBINED-CYCLE DEVELOPMENT PROGRAM, PHASE 1 Interim Report
F. H. Boenig and J. H. Lewis Oct. 1980 544 p
(EPRI Proj. 1187-1)
(EPRI-AP-1599-Vol-1) Avail: NTIS HC A23/MF A01

Phase 1 of a multiphase program leading to the development of a High Reliability Gas Turbine is described. The engine would be used for base load, combined cycle applications. Phase 1 was a conceptual design study of both the gas turbine itself and the full plant. High reliability was reflected in a concept that features ruggedness and simplicity. Ease of maintenance was provided through structural simplicity and modularization. Component designs for the gas turbine were selected on the basis of a review of past operational experience and an in depth statistical reliability analysis. Design details were then determined using trade off and parametric studies. Reliability in the auxiliary and balance of plant waste heat recovery equipment was provided by redundancy of critical components as well as the use of proven equipment. The final gas turbine design is a 107 MW, single shaft engine. Projected availability for the final engine installed in a combined cycle plant is 92 percent. DOE

N81-19467# Rolls-Royce Ltd., Derby (England).
NEW PROCESS IN SURFACE TECHNOLOGY: BALL BURNISHING
M. Bormann 1980 12 p Transl. into ENGLISH from Oberflaechet JOT, v. 5, 1979
(PNR-90041; Trans-15259) Avail: NTIS HC A02/MF A01

The use of ball burnishing for deburring metal parts is discussed in terms of its applicability to mass-production manufacturing. The machinery, fluids and chips used in the ball process are compared with those required by other methods. A cost evaluation is given for vibratory grinding versus ball burnishing for punched parts in an automobile braking system.

Author (ESA)

N81-19468# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

ADVANCED INDUSTRIAL ROBOT CONTROL SYSTEMS Progress Report, 1 Jul. 1979 - 1 Jan. 1980

R. Paul, J. Luh, S. Y. Nof, D. Brandin, H. Lechtman, and C.-H. Wu Jul. 1980 54 p refs

(Grant NSF APR-77-14533)

(PB81-122517; TR-EE80-30; NSF/RA-800228; PR-5) Avail: NTIS HC A04/MF A01 CSCL 13I

Robot and human operator capabilities in performing industrial tasks were analyzed and a work methodology developed for industrial robots. Standard elementary robot motion and Reach Task Motion (RTM) Tables were developed which specify estimated Stanford Arm time requirements to perform individual motions. Robot and human task performance methods were compared using a water pump assembly. Differences observed were due to the robot's lack of finger dexterity, limited input sensing capability relative to human senses, and the use of only one arm. These limitations can be overcome by proper methods, placing, and workplace design. Robot performance required over eight times the estimated human performance time. Results indicate that RTM may provide a useful methodology in the analysis and design of robot work. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-19469 Virginia Polytechnic Inst. and State Univ., Blacksburg.

OPTIMAL RELIABILITY DESIGN FOR COMPLEX SYSTEMS Ph.D. Thesis

Jae Yearn Kim 1980 87 p

Avail: Univ. Microfilms Order No. 8101887

The problem of maximizing system reliability subject to resource constraints is addressed in the framework of determining the optimum number of components and the optimum component reliabilities so as to maximize system reliability. The resulting problem, called the integrated reliability optimization problem, may be classified as corresponding to a mixed integer nonlinear mathematical programming problem. The integrated reliability optimization problem, as mathematically formulated, is transformed into a model that is more amenable to existing solution techniques. It is shown that the solution of the transformed problem is equivalent to the solution of the original problem. Two integrated reliability optimization models are transformed and solved using Powell's optimization algorithm. Numerical results indicated that the solution of the integrated reliability optimization problem may be accomplished quite effectively with this solution algorithm. Dissert. Abstr.

N81-19470# Rockwell International Corp., Thousand Oaks, Calif.

PROCEEDINGS OF THE DARPA/AFML REVIEW OF PROGRESS IN QUANTITATIVE NONDESTRUCTIVE EVALUATION Annual Report, 1 Jul. 1978 - 30 Sep. 1979

Donald O. Thompson and R. Bruce Thompson Wright-Patterson AFB, Ohio AFWAL Jul. 1980 752 p refs Proceedings held at La Jolla, Calif., 8-13 Jul. 1979

(Contract F33615-74-C-5180; AF Proj. 7351)

(AD-A094826; SC595.70AR; AFWAL-TR-80-4078; AR-5) Avail: NTIS HC A99/MF A01 CSCL 11/2

The edited transcripts of the DARPA/AF Review of Progress in Quantitative Nondestructive Evaluation (NDE) held on July 8-13, 1979, at Scripps Institution of Oceanography, La Jolla, California, are presented in this document. Several key topics form the core of these presentations and discussions.' They include quantitative ultrasonics, eddy currents, emissions related to failure prediction, and reliability of metals and ceramics. It is believed that this document provides a reasonable summary of NDE research and development currently underway. GRA

N81-19471# California Univ., Berkeley. Operations Research Center.

LOAD SHARING MODELS AND THEIR LIFE DISTRIBUTIONS

Zvi Schechner (Columbia Univ., N.Y.) Sep. 1980 57 p refs

(Grant AF-AFOSR-3213-77; AF Proj. 2304)

(AD-A095066; ORC-80-19) Avail: NTIS HC A04/MF A01 CSCL 14/4

An N-component parallel system is subjected to a known load program. As time passes, components fail in a random manner which depends on their individual load histories. At any time t, the surviving components share the total load according to some rule. The system's lifetime distribution is studied under various breakdown rules. Under the linear breakdown rule it is shown that if the load program is increasing the system lifetime is IFR. Using the notion of Schur convexity, stochastic comparison of difference systems is obtained. It is also shown that the system failure time is asymptotically normally distributed as the number of components grows large. All these results hold under various load sharing rules, in fact, one can prove that the system lifetime distribution is invariant under different load sharing rules. For a more general breakdown rule only the equal load sharing is considered. The asymptotic distribution of the system lifetime is shown to be normal. The asymptotic mean and variance are derived. GRA

N81-19472# California Univ., Berkeley. Operations Research Center.

CONDITIONALLY INCREASING PROCESSES

Zvi Schechner Nov. 1980 18 p refs

(Grant AF-AFOSR-3213-77; AF Proj. 2304)

(AD-A095067; ORC-80-24) Avail: NTIS HC A02/MF A01 CSCL 12/1

The conditional distribution of X(t) given sup X(u) + a where u varies from 0 to t of certain processes is studied. We use it to prove the IFR property of k-out-of-n systems and certain shock models and other processes. GRA

N81-19473# California Univ., Berkeley. Operations Research Center.

LIFE DISTRIBUTION MODELS AND INCOMPLETE DATA

Richard E. Barlow and Frank Proschan (Florida State Univ., Tallahassee) Sep. 1980 59 p refs Prepared in cooperation with Florida State Univ., Tallahassee

(Grant AF-AFOSR-3179-77; AF Proj. 2304)

(AD-A095068; ORC-80-20) Avail: NTIS HC A04/MF A01 CSCL 21/1

This report represents the second chapter of a book in preparation of inference and data analysis in reliability and life testing. The point of view adopted differs from that of most books on the subject in the following basic respect, prior information available to the reliability analysis is utilized fully in a formal statistical fashion. Experience accumulated in helping engineers, quality assurance managers, scientists, biostatisticians, and others who must make estimates and reach decisions from either planned experiments or retrospective data has shown us that the point of view adopted throughout the book has resulted in useful solutions to real life problems. By contrast, more classical statistical methods have often proven inadequate in many practical problems simply because the data available are insufficient to reach conclusions with a desired degree of assurance. The book is intended primarily for actual use by the engineering and scientific practitioner, rather than for theoretical study and philosophical analysis by the statistician. GRA

N81-19474# California Univ., Berkeley. Operations Research Center.

AVAILABILITY OF SERIES SYSTEMS WITH COMPONENTS SUBJECT TO VARIOUS SHUT-OFF RULES

Zohel S. Khalil (Concordia Univ., Montreal, Canada) Jun. 1980 21 p refs Sponsored in Part by Natural Sciences and Engineering Research Council, Canada

(Grant AF-AFOSR-3179-77; AF Proj. 2304)

(AD-A095140; ORC-80-12) Avail: NTIS HC A02/MF A01

CSCL 12/1

In this report we consider different shut-off rules for series systems performance. We calculate limiting system availability under various shut-off rules. In particular, availability results for 2 and 3 unit systems with all failure and repair distributions exponential extended to systems of arbitrary size. Consider a series of system of n components. System failure in such systems coincides with component failure. However, in many systems components can still be functioning after system failure occurs, or some components on failure will shut off others. This means that some shut-off rules can be established for system performance, such as failure of first component shuts off the second and next components or failure of second component shuts off third and higher components but not the first and so on. For example, in a 3 unit system, unit 1 on failure shuts off both unit 2 and 3, unit 2 on failure shuts off only unit 3, but not 1, and units 1 and 2 are not affected when failure of unit 3 occurs. GRA

N81-19475# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

A COMPARISON OF THE ACCURACY OF UNIVARIATE AND VIBARIATE TECHNIQUES FOR FINDING THE LOWER CONFIDENCE LIMITS OF SYSTEM RELIABILITY M.S. Thesis

Kathleen Mary DePuy Dec. 1980 207 p refs
(AD-A094810; AFIT/GOR/OS/80D-223) Avail: NTIS HC A10/MF A01 CSCL 12/1

The purpose of this thesis is to compare the accuracy of two Monte Carlo simulation techniques of finding lower system reliability confidence limits: the bivariate technique and the univariate technique. The actual results compared are the confidence interval coverages of the true system reliability associated with the confidence limits. The bivariate technique is based upon the assumption that the maximum likelihood estimators of the component shape and scale parameters have an asymptotic normal distribution. The univariate technique uses the assumption that the component reliability estimates have a normal distribution. Two variations of the univariate technique are also examined. The first variations assumes that component reliability estimates follow a beta distribution instead of a normal distribution. The second variation replaces all perfect system reliability estimates with new, adjusted reliability values. GRA

N81-19476# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A MODIFIED DOUBLE MONTE CARLO TECHNIQUE TO APPROXIMATE RELIABILITY CONFIDENCE LIMITS OF SYSTEMS WITH COMPONENTS CHARACTERIZED BY THE WEIBULL DISTRIBUTION M.S. Thesis

James Ward Johnston, Jr. Dec. 1980 72 p refs
(AD-A094833; AFIT/GOR/OS/80D-5) Avail: NTIS HC A04/MF A01 CSCL 12/1

A modified Double Monte Carlo technique is developed for determination of lower confidence limits of system reliability based on component test data. It is assumed that the components test data consists of failure times, which are distributed according to a known two parameter Weibull probability distribution. These failure times are randomly generated using the true shape and scale parameters of the distribution. Maximum likelihood estimators are twice obtained for the shape and scale parameters and then substituted into the reliability equation to obtain an estimator for the component reliability. A given number of these estimators are obtained and used to form an empirical distribution of reliabilities for each component. A given number of samples from this distribution are used to calculate various system reliabilities. Since the true system reliability is known, it can be determined if a given confidence interval contains the true number, hence giving you a method of validating any confidence interval. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-19477 Washington Univ., St. Louis, Mo.

DESIGN CRITERIA FOR ALUMINUM COLUMNS AND BEAM-COLUMNS Ph.D. Thesis

Jacques Philippe Chapuis 1980 302 p
Avail: Univ. Microfilms Order No. 8103706

The resistance of aluminum elements and variations of that resistance are considered. The statistical properties are described through mean values and coefficents of variation. The effect of material and cross-sectional properties are taken into account as well as initial imperfection, end restraint and eccentricity of the load. The use of interaction equations and effective length factors is investigated to determine how well they describe the strength members. The reliability of the current aluminum code is analyzed through order second moment methods from which a reliability index target is deduced in order to determine the resistance factors of (load and resistance factors design) criteria. The proposed new design criteria are shown to offer a more uniform reliability and thus represent an improvement over the current code. Dissert. Abstr.

N81-19478*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

OUTER PLANET PROBE ENGINEERING MODEL STRUCTURAL TESTS

J. A. Smittkamp, W. H. Gustin, and M. W. Griffin Sep. 1977 159 p refs
(Contract NAS2-9027)
(NASA-CR-152036) Avail: NTIS HC A08/MF A01 CSCL 20K

A series of proof of concept structural tests was performed on an engineering model of the Outer Planets Atmospheric Entry Probe. The tests consisted of pyrotechnic shock, dynamic and static loadings. The tests partially verified the structural concept. Author

N81-19479*# Textron Bell Aerospace Co., Buffalo, N. Y.

AEROELASTIC AND DYNAMIC FINITE ELEMENT ANALYSES OF A BLADDER SHROUDED DISK

G. C. C. Smith and V. Elchuri Mar. 1980 152 p refs
(Contract NAS3-20382)
(NASA-CR-159728; D2536-941001) Avail: NTIS HC A08/MF A01 CSCL 20K

The delivery and demonstration of a computer program for the analysis of aeroelastic and dynamic properties is reported. Approaches to flutter and forced vibration of mistuned discs, and transient aerothermoelasticity are described. R.C.T.

N81-19480*# Textron Bell Aerospace Co., Buffalo, N. Y.

NASTRAN LEVEL 16 THEORETICAL MANUAL UPDATES FOR AEROELASTIC ANALYSIS OF BLADED DISCS

V. Elchuri and G. C. C. Smith Mar. 1980 24 p refs
(Contract NAS3-20382)
(NASA-CR-159823; D2536-941002) Avail: NTIS HC A02/MF A01 CSCL 20K

A computer program based on state of the art compressor and structural technologies applied to bladed shrouded disc was developed and made operational in NASTRAN Level 16. Aeroelastic analyses, modes and flutter. Theoretical manual updates are included. S.F.

N81-19481*# Textron Bell Aerospace Co., Buffalo, N. Y.

NASTRAN LEVEL 16 USER'S MANUAL UPDATES FOR AEROELASTIC ANALYSIS OF BLADED DISCS

V. Elchuri and A. M. Gallo Mar. 1980 167 p refs
(Contract NAS3-20382)
(NASA-CR-159824; D2536-941003) Avail: NTIS HC A08/MF A01 CSCL 20K

The NASTRAN aeroelastic and flutter capability was extended to solve a class of problems associated with axial flow tur-

bomachines. The capabilities of the program are briefly discussed. The aerodynamic data pertaining to the bladed disc sector, the associated aerodynamic modeling, the steady aerothermoelastic 'design/analysis' formulations, and the modal, flutter, and subcritical roots analyses are described. Sample problems and their solutions are included. R.C.T.

N81-19482*# Textron Bell Aerospace Co., Buffalo, N. Y.
NASTRAN LEVEL 16 PROGRAMMER'S MANUAL UPDATES FOR AEROELASTIC ANALYSIS OF BLADED DISCS
A. M. Gallo and B. Dale Mar. 1980 88 p refs
(Contract NAS3-20382)
(NASA-CR-159825; D2536-941004) Avail: NTIS HC A05/MF A01 CSCL 20K

The programming routines for the NASTRAN Level 16 program are presented. Particular emphasis is placed on its application to aeroelastic analyses, mode development, and flutter analysis for turbomachine blades. R.C.T.

N81-19483*# Textron Bell Aerospace Co., Buffalo, N. Y.
NASTRAN LEVEL 16 DEMONSTRATION MANUAL UPDATES FOR AEROELASTIC ANALYSIS OF BLADED DISCS
V. Elchuri and A. M. Gallo Mar. 1980 15 p refs
(Contract NAS3-20382)
(NASA-CR-159826; D2536-941005) Avail: NTIS HC A02/MF A01 CSCL 20K

A computer program based on state of the art compressor and structural technologies applied to bladed shrouded discs was developed and made operational in NASTRAN level 16. The problems encompassed include aeroelastic analyses, modes, and flutter. The demonstration manual updates are described. L.F.M.

N81-19484*# Bell Aerospace Co., Buffalo, N. Y.
DESIGN AND FABRICATION OF A STRINGER STIFFENED DISCRETE-TUBE ACTIVELY COOLED PANEL FOR A HYPERSONIC AIRCRAFT Final Contractor Report
Frank M. Anthony and Robert G. Halenbrook Washington NASA Feb. 1981 89 p refs
(Contract NAS1-12806)
(NASA-CR-3403; Rept-7430-927001) Avail: NTIS HC A05/MF A01 CSCL 20K

A 0.61 x 1.22 m (2 x 4 ft) test panel was fabricated and delivered to the Langley Research Center for assessment of the thermal and structural features of the optimized panel design. The panel concept incorporated an aluminum alloy surface panel actively cooled by a network of discrete, parallel, redundant, counterflow passage interconnected with appropriate manifolding, and assembled by adhesive bonding. The cooled skin was stiffened with a mechanically fastened conventional substructure of stringers and frames. A 40 water/60 glycol solution was the coolant. Low pressure leak testing, radiography, holography and infrared scanning were applied at various stages of fabrication to assess integrity and uniformity. By nondestructively inspecting selected specimens which were subsequently tested to destruction, it was possible to refine inspection standards as applied to this cooled panel design. A.R.H.

N81-19485*# General Dynamics/Convair, San Diego, Calif.
MODULAR REFLECTOR CONCEPT STUDY Final Contractor Report, Apr. 1979 - Feb. 1980
D. H. Vaughan Washington NASA Mar. 1981 119 p refs
(Contract NAS1-15753)
(NASA-CR-3411; GDC-ASP-79-003) Avail: NTIS HC A06/MF A01 CSCL 20K

A study was conducted to evaluate the feasibility of space erecting a 100 meter paraboloidal radio frequency reflector by joining a number of individually deployed structural modules. Three module design concepts were considered: (1) the deployable cell module (DCM); (2) the modular paraboloidal erectable truss antenna (Mod-PETA); and (3) the modular erectable truss antenna (META). With the space shuttle (STS) as the launch system, the methodology of packaging and stowing in the orbiter, and of dispensing, deploying and joining, in orbit, were studied and the necessary support equipment identified. The structural performance of the completed reflectors was evaluated and their overall operational capability and feasibility were evaluated and compared. The potential of the three concepts to maintain stable shape in the space environment was determined. Their ability to operate at radio frequencies of 1 GHz and higher was assessed assuming the reflector surface to consist of a number of flat, hexagonal facets. A parametric study was performed to determine figure degradation as a function of reflector size, flat facet size, and f/D ratio. Author

N81-19486*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PREDICTION OF FATIGUE-CRACK GROWTH UNDER VARIABLEAMPLITUDE AND SPECTRUM LOADING USING A CLOSURE MODEL
J. C. Newman, Jr. Jan. 1981 38 p refs Presented at the ASTM Symp on Design of Fatigue and Fracture Resistant Struct., Bal Harbour, Fla., 10-14 Nov. 1980
(NASA-TM-81942) Avail: NTIS HC A03/MF A01 CSCL 20K

An existing analytical crack closure model was used to study crack growth under various load histories. The model was based on a concept like the Dugdale model, but modified to leave plastically deformed material in the wake of the advancing crack tip. The model was used to correlate crack growth rates under constant amplitude loading, and to predict crack growth under variable amplitude and aircraft spectrum loading on 2219-T851 aluminum alloy sheet material. The predicted crack growth lives agreed well with experimental data. For 80 crack growth tests subjected to various load histories, the ratio of predicted-to-experimental lives (N(P)/n(T)) ranged from 0.5 to 1.8. The mean value of N(P)/N(T) was 0.97 and the standard deviation was 0.27. E.D.K.

N81-19487*# National Aeronautics and Space Administration, Washington, D. C.
ANISOTROPY OF MACHINE BUILDING MATERIALS
Ye. K. Ashkenazi Mar. 1981 102 p refs Transl. into ENGLISH of the book "Anizotropiya Mashinostroitel'nykh Materialov" Leningrad, Mashinostroyeniye Press, 1969 p 1-111 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76536) Avail: NTIS HC A06/MF A01 CSCL 20K

The results of experimental studies of the anisotropy of elastic and strength characteristics of various structural materials, including pressure worked metals and alloys, laminated fiberglass plastics, and laminated wood plastics, are correlated and classified. Strength criteria under simple and complex stresses are considered as applied to anisotropic materials. Practical application to determining the strength of machine parts and structural materials is discussed. M.G.

N81-19488*# National Aeronautics and Space Administration, Washington, D. C.
FRACTURE CONTROL PLAN FOR PROPELLANT AND PRESSURANT TANKS
Feb. 1981 16 p Transl. into ENGLISH of "Fracture Control Plan for Treibstoff-und Druckgastanks" Rept. RPM-PL-1200-01-01 Ottobrunn, West Germany, 18 Apr. 1980 10 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by MBB, Ottobrunn, West Germany
(Contract NASw-3198)
(NASA-TM-76554) Avail: NTIS HC A02/MF A01 CSCL 20K

To assure the functional integrity of the GLL-RPM fuel and pressurized gas tank, all activities during entire lifetime of the tank, from manufacture to the end of the mission, must be monitored. Specifications are given for all procedures which influence the tank structure including design, manufacture, cleaning, test operations, and storage. Tests to be conducted to demonstrate that requirements of the fracture control plan are satisfied include static tests, cyclic load tests, proof tests, He-leak test, and acceptance tests. A.R.H.

N81-19489# Boeing Aerospace Co., Seattle, Wash.
PROGRAM FOR NONLINEAR STRUCTURAL ANALYSIS Interim Technical Progress Report, Apr. 1979 - Jun. 1980
R. E. Jones Jun. 1980 7 p
(Contract F49620-79-C-0057; AF Proj. 2307)
(AD-A094510; AFOSR-81-0019TR) Avail: NTIS

HC A02/MF A01 CSCL 13/13

A finite element computer code is under development which is specialized to strong nonlinearities of the geometrical type. The work includes beam and shell elements and makes use of three important technical features to best address the nonlinear problem. These are: (1) the use of higher degree functions for the membrane or axial displacements than for the bending displacements; (2) the use of the static perturbation method; and (3) the use of Euler angles to represent rotations. Computed results illustrate the methods and computer codes developed. GRA

N81-19490# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

STUDY OF RESIDUAL STRESSES AND DISTORTION IN STRUCTURAL WELDMENTS IN HIGH STRENGTH STEELS Technical Progress Report

Vassilios J. Papazoglou and Koichi Masubuchi 30 Nov. 1980 73 p refs

(Contract N00014-75-C-0469)

(AD-A094963; TPR-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

Experimental results on temperature, strain, and distortion during welding HY-130 steel are presented. The geometries include 1 inch thick plates and 0.75 inch cylindrical shells. Welding was performed using the gas metal arc, electron beam and laser processes. The experimental results are compared with predictions made by computer programs. Finally, through thickness distributions of residual stresses obtained using the Rosenthal-Norton sectioning technique are presented. GRA

N81-19491# Belytschko (Theodore B.), Chicago, Ill.

METHODS OF FORCE IDENTIFICATION FOR EARTH PENETRATORS Final Report, 1 Jul. 1976 - 1 Dec. 1977

T. B. Belytschko 1 Jan. 1980 57 p refs

(Contract DNA001-76-C-0167)

(AD-A095122; DNA-5289F) Avail: NTIS HC A04/MF A01 CSCL 19/4

A procedure is developed for identifying the forces on the nose of a penetrator vehicle from strain time histories at selected points in the vehicle in off-normal impact of the vehicle. The vehicle nose is idealized as a rigid body, the remainder as a deformable rod. The following forces are considered: axial forces, transverse forces in two planes, and bending moments. The deformation response of the vehicle is assumed to be linear. The identification is separated into the identification of the flexural forces and axial forces. GRA

N81-19492# MARC Analysis Research Corp., Palo Alto, Calif.

KNOWLEDGE BASED CONSULTATION FOR FINITE ELEMENT STRUCTURAL ANALYSIS Final Report, Oct. 1977 - May 1980

J. M. Rivlin, M. B. Hsu, and P. V. Marcal Wright-Patterson AFB, Ohio AFWAL May 1980 114 p refs

(Contract F33615-78-C-3206; AF Proj. 2401)

(AD-A095146; AFWAL-TR-80-3069) Avail: NTIS HC A06/MF A01 CSCL 13/13

In recent years, techniques of 'heuristic programming' have been applied to various fields of science and engineering. An attempt has been made, during the current investigation, to develop a knowledge based consultation system and to establish a finite element structural analysis knowledge based for the use of the MARC program, a general purpose finite element analysis program. Backward chaining logic is adopted into the current system and the inference engine is written in FORTRAN. The knowledge based deals with information on pre-analysis, and post-analysis stages of a structural analysis problem. Rules in the knowledge base are executed through the use of user input keywords. The consultation system is currently operational on the Prime 400 Computer System. GRA

N81-19493# Universal Energy Systems, Inc., Dayton, Ohio.

USE OF REISSNER'S VARIATIONAL PRINCIPLE IN FINITE ELEMENT ANALYSIS OF CRACK PROBLEMS. Final Report, Jun. - Sep. 1980

Jalees Ahmad Dec. 1980 31 p refs

(Contract F33615-79-C-5129; AF Proj. 2307)

(AD-A094901; AFWAL-TR-80-4182) Avail: NTIS HC A03/MF A01 CSCL 20/11

For the purpose of accurately estimating linear elastic fracture parameters by finite element method, the use of Reissner's variational principle as a basis is investigated. Results of two dimensional analyses performed on three point bend, compact tension, and ring tension geometries compare well with other solutions available in the literature. Results of three dimensional analyses of three point bend and ring geometries are also presented. The method appears to be particularly useful in studying through the thickness variation or Mode I stress intensity factors. GRA

N81-19494# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

INSTABILITY OF SHORT CIRCULAR CYLINDRICAL LAMINATED COMPOSITE SHELLS UNDER PURE BENDING M.S. Thesis

Victor J. Villhard Dec. 1980 109 p refs

(AD-A094737; AFIT/GAE/AA/80D-24) Avail: NTIS HC A06/MF A01 CSCL 11/4

Short cylindrical shells made from symmetrical laminated advanced composites were analyzed with the intent of examining the effects of certain shell properties on shell instability. Four laminates were considered over a range of length to radius ratio of 1/2 to 10. Reinforcing fiber stiffness was also varied so that the effects of stiffening the laminates could be observed. Shell bending bifurcation analysis was performed using the STAGS-C computer code with a kinematic end rotation applied to the shell to produce the desired shell bending. Axial compression bifurcation comparison runs were also made using the STAGS-C program. GRA

N81-19495# Rockwell International Corp., Golden, Colo.

WIND MACHINE FATIGUE ANALYSIS AND LIFE PREDICTION

C. A. Waldon Apr. 1980 66 p refs

(Contract DE-AC04-76DP-03533)

(RFP-3135/3533/80-19) Avail: NTIS HC A04/MF A01

A technique for measuring fatigue and predicting fatigue life for different wind regimes is described. Presented are the techniques for locating high stress measuring points, obtaining data, using computer programs for calculating fatigue reduction, and finally predicting fatigue life. DOE

N81-19496# Hoegskolan i Luleaa (Sweden). Dept. of Mechanical Engineering.

STRESS IN A TOWING WIRE DUE TO ACCELERATIONS OF THE TOWING VEHICLE

Carlos Matuk 1979 27 p refs Sponsored by Swedish Defense Material Administration

(TR-1979-33-T) Avail: NTIS HC A03/MF A01

The dynamic stress in the towing wire is considered. It is assumed that the wire obeys a one dimensional wave equation. The dynamic stress due to an arbitrary acceleration is determined and the stress caused by a rectangular acceleration pulse is computed numerically. Graphs showing the dependence of the maximum dynamic stress on the system parameters are given. They can be used to determine allowable accelerations of the towing vehicle when the aerodynamic or hydrodynamic drag forces, and the strength of the wire, are known. Author (ESA)

N81-19497# Atomic Energy Commission Research Establishment, Riso (Denmark). Engineering Dept.

STATIC DEFLECTION AND EIGENFREQUENCY ANALYSIS OF THE NIBE WIND TURBINE ROTORS. THEORETICAL BACKGROUND

Per Lundsager Feb. 1980 31 p refs

(RISOE-M-2199; ISBN-87-550-0627-2; ISSN-0418-6435) Avail: NTIS HC A03/MF A01

The theory of thin-walled multicell structures is used to calculate the cross-sectional properties of rotor blades. The theory is developed for beams of inhomogeneous materials. The blade is then modeled using the finite element method. A stayed and a cantilevered blade, each consisting of a steel part and a glass fiber part, were analyzed. Static deflection caused by extreme wind load along with the five to ten lowest eigenfrequencies were calculated. Results deviated less than 15 percent from theoretical predictions. Author (ESA)

N81-19498# Oxford Univ. (England). Dept. of Engineering Science.

EXACT STRAIGHT LINE ELEMENTS

Edgar Lightfoot 1979 21 p refs

(OUEL-1299/79) Avail: NTIS HC A02/MF A01

A method of obtaining exact finite element stiffnesses directly from governing differential equations is explained and another method which used the column analogy is indicated. These can both be modified by matrix manipulation to allow for relaxed restraint conditions. Exact stiffness matrices are given for the straight prismatic beam, the beam-column (or tie), the vibrating beam-column (or tie), the tapered beam and the annular slab. They are compared briefly with matrices obtained from simple polynomial approximations. Further exact finite elements are possible which minimize convergence problems.

Author (ESA)

N81-19499# Technische Hogeschool, Delft (Netherlands). Dept. of Mechanical Engineering.

A GEOMETRICALLY NONLINEAR FINITE ELEMENT SHELL THEORY: APPLICATIONS TO THE POSTBUCKLING BEHAVIOR OF SHELLS

L. J. Ernst May 1980 26 p refs

(WTHD-126) Avail: NTIS HC A03/MF A01

A perturbation method for the description of buckling phenomena is presented. The utilization of a simple finite element method which provides independent states of membrane deformation and bending deformation and which adequately describes the general theory of thin elastic shells is described. The solution of the large system of nonlinear equations is now replaced by the solution of a relatively small system of nonlinear equations, in addition to a linear analysis and an eigenvalue analysis for the first few bulkling modes. Some computational examples are given. Author (ESA)

N81-19500# GEC Power Engineering Ltd., Whetstone (England).

COMPARISON OF DIFFERENT FRACTURE MECHANICS TEST PROCEDURES WHICH GIVE CRITICAL VALUES IN THE DESCRIPTION OF FRACTURE BEHAVIOR

C. Berger, U. Schieferstein, and W. Wiemann Oct. 1980 32 p refs Presented at 9th German Mater. Testing Assoc. Fracture Behavior Working Party Session, 11-12 Oct. 1977

(GEC-Trans-2067) Avail: NTIS HC A03/MF A01

The methods used in elastoplastic fracture mechanics for the determination on reduced scale models of fracture resistances comparable to those given by the ASTM E 399 concept are reviewed. The experimental values are compared. Included are the equivalent energy method the J-integral concept and the crack opening displacement concept. It is concluded that these methods provide sufficiently exact determination of critical fracture resistance from reduced scale specimen tests. Author (ESA)

N81-19501# European Space Agency, Paris (France).

THEORY AND CALCULATION METHODS OF VIBRATING STRUCTURES

Roger Valid Dec. 1980 94 p refs Transl. into ENGLISH of "La Theorie et les Methodes de Calcul des Struct. en Vibration" ONERA, Paris Rept. ONERA-P-1980-1, 1980 Presented at CEA/EDF Conf. on Vibrations of Struct. in Ind. Settings, Jouy-en-Josas, France, 15-19 Oct. 1979 Original report in FRENCH previously announced as N80-31849

(ESA-TT-663; ONERA-P-1980-1) Avail: NTIS HC A05/MF A01

The finite element method is reviewed through use of the displacement method. Some details of the most common elements are given. The theory of linear vibrations is presented in the discretized case. Its properties, particularly variational ones, were reviewed in both the discrete and continuous cases. The main methods of dynamic condensation are described and standard formulas for response to specified excitations, whether transient, harmonic, periodic or random are given. Calculation methods for structures with geometric non linearities are presented in variational form. Calculation algorithms for arbitrary excitations were reviewed. The study of the stability of dynamic systems is introduced. Author (ESA)

N81-19502# Sydney Univ. (Australia). Civil Engineering Labs.

INPLANE STABILITY OF PARABOLIC ARCHES

H. B. Harrison Apr. 1980 27 p refs

(PB81-114423; R-363) Avail: NTIS HC A03/MF A01 CSCL 20K

Some numerical studies are reported of the response to uniformly distributed loading of parabolic arches of rise equal to a fourth of the span. Base conditions are both fixed and pinned. The distributed loading varies between covering less than half the span to covering the complete span. The numerical studies use a discrete element, large deformation method that enables the prediction of the complete load deformation history of an elastic arch up to full inversion if necessary. Account is taken of axial as well as flexoral strains and, under full span loading published data are confirmed for the load intensities at which equilibrium bifurcation occurs. GRA

N81-19503# Sydney Univ. (Australia). Civil Engineering Labs.

MULTIPLE COLUMN CURVES BY MODIFYING FACTORS

J. M. Rotter May 1980 14 p refs

(PB81-114431; R-366) Avail: NTIS HC A02/MF A01 CSCL 20K

There are two principal disadvantages in the use of multiple column curves as they are currently formulated. First, they are represented either by equations which are cumbersome to use or by tables with a new table for each column curve. Second, the change so that it may be difficult to decide which curve should represent some sections and it is possible for anomalies to arise. These two disadvantages are removed in the proposed method, in which the three SSRC curves are represented by a single curve and a single linear modifying function. The modifying function was chosen to allow smooth transitions between the existing SSRC curves and to make step changes between the curves unnecessary. GRA

N81-19504# Swedish Council for Building Research, Stockholm.

DESIGN OF TRAPEZOIDAL SHEETING PROVIDED WITH STIFFENERS IN THE FLANGES AND WEBS

Torsten Hoglund 1980 82 p refs

(PB81-114506; ISBN-91-540-3309-8; D28-1980) Avail: NTIS HC A05/MF A01 CSCL 13M

Design methods for cold formed steel structural members were developed. In order to make the sheets more economical, the profile depth was increased. Allowable bending moments and support reactions were then based on statistically treated test results. For trapezoidal sheets without intermediate stiffeners a design method based on those tests, was developed. Once the construction technique had become established, attention concentrated on improvement of existing products and utilization of new fields of application. Tests showed that design methods in for profiled sheets with intermediate stiffeners give results on the unsafe side for those shapes which were thought to be optimal. Allowable bending moments were therefore based on a number of tests made by or on behalf of sheet manufacturers.

GRA

N81-19505# Swedish Council for Building Research, Stockholm.

IMPACT LOADS PRODUCED BY HUMAN MOTION. PART 2: REQUIREMENTS FOR STRUCTURES AND METHODS OF TEST

Leif Nilsson 1980 221 p refs

(PB81-114498; ISBN-91-540-3263-6; D20-1980) Avail: NTIS HC A10/MF A01 CSCL 13M

Impact loads produced by human motion exerted on lightweight and/or brittle structural components give rise to stresses of such intensity that special attention must be paid to their effects. These impact loads are significant in two different ways, firstly from the standpoint of the safety of the person performing the movement, and secondly from the standpoint of the structural performance such as permissible deformation, crack width, etc. A systematic subdivision into primary and secondary groups of building elements which are sensitive to such impact effects is presented. For each group, requirements are given which take into account not only the effect of the load but also the frequency of occurrence of the motion and the consequences of a failure or some other damage to the construction. Details are given of extensive calibration tests on test prototypes which make possible the specification of test models which are capable

of reproducing the movements on which design is to be based. GRA

N81-19506# California Univ., Berkeley. Earthquake Engineering Research Center.
EFFECTS OF AMOUNT AND ARRANGEMENT OF WALL-PANEL REINFORCEMENT ON HYSTERETIC BEHAVIOR OF REINFORCED CONCRETE WALLS
Ramzi Iliya and Vitelmo V. Bertero Feb. 1980 183 p refs
(Grants NSF ENV-76-04263; NSF PFR-79-08984)
(PB81-122525; UCB/EERC-80/04; NSF/RA-800191) Avail: NTIS HC A09/MF A01 CSCL 13M

The effectiveness of the epoxy injection technique for repairing damaged walls, methods of strengthening walls after their local failure, and the effects of construction joints were investigated using two one third scale models of the three bottom stories of the wall of a ten story frame wall R/C building designed according to UBC/73 seismic code requirements. In one model equal amounts of horizontal and vertical reinforcement were used in the wall panel, while in the other specimen the panel reinforcement was arranged diagonally at 45 degrees. Each specimen was subjected to three series of three tests. The results obtained are evaluated, dicussed, and compared with the results from earlier experiments. GRA

N81-19507# Purdue Univ., Lafayette, Ind.
A RULE-INFERENCE METHOD FOR DAMAGE ASSESSMENT OF EXISTING STRUCTURES
M. Ishizuka, K. S. Fu, and J. T. P. Yao Jul. 1980 13 p refs
(Grant NSF PER-79-06296)
(PB81-119521; CE-STR-80-8; NSF/RA-80020) Avail: NTIS HC A02/MF A01 CSCL 13M

A damage assessment methodology to determine the damage states of existing structures after an earthquake is described. A definitive and rational methodology can contribute to correct decisions in repairing structures, predicting future damage, and improving technologies for aseismic structures. The proposed approach implements an inference or reasoning procedure similar to that used by experts in computer programming. It consists of a question and answer subsystem which facilitates an efficient interactive man-machine interface and responds upon request of the user and controller to collect necessary data for assessment. Data include field observations and as much structural information as possible with respect to the building being assessed. GRA

N81-19508# Cornell Univ., Ithaca, N. Y. Dept. of Structural Engineering.
BEHAVIOR OF HIGH-STRENGTH CONCRETE UNDER SUSTAINED COMPRESSIVE STRESS
Ali Salem Ngab Feb. 1980 217 p refs
(Grant NSF ENG-78-0514)
(PB81-124075; NSF/RA-800239) Avail: NTIS HC A10/MF A01 CSCL 13C

Time dependent deformational and strength characteristics were investigated. A direct comparison was made to the behavior of normal strength concrete subjected to similar relative stresses under the same environmental conditions. Deformational behavior related to moisture movements and internal progressive microcracking also was investigated. Sealed and unsealed concrete specimens were analyzed for internal microcracking after being subjected to short term drying shrinkage and creep strains. Results indicate the following: (1) time dependent deformation is less for high strength concrete than for normal strength concrete; (2) the amount of internal progressive microcracking associated with short term shrinkage and creep is considerably less in high strength concrete than in normal strength concrete; and (3) the creep stress relation of high strength concrete is linear over a larger range than that in normal strength concrete. GRA

42 GEOSCIENCES (GENERAL)

N81-19509# Montpellier Univ. (France). Lab. de Physique Mathematique.
SOME TOPICS ON INVERSION THEORY APPLIED IN GEOPHYSICS
Pierre C. Sabatier Nov. 1979 43 p refs Presented at Intern. Symp. on Ill-posed Probl.: Theory and Practice, Newark, Del., 2-6 Oct. 1979
(PM/79/24) Avail: NTIS HC A03/MF A01

A brief survey of linearized inverse problems and some recent developments are presented as an introduction to the treatment of truly nonlinear inverse problems. Extreme solutions for finite data were examined. Some previous work was related to the trace formulas, and equalities concerning toroidal modes were obtained by the trace method. The inverse scattering methods and the isospectral evolution are then discussed and their applications to geophysics are outlined. Results concerning gravity waves and baroclinic waves are discussed. Author (ESA)

N81-19510# International Geophysical Year World Data Center A, Boulder, Colo.
GEODYNAMICS INTERNATIONAL 16
May 1980 121 p Prepared in cooperation with Inter-Union Commission on Geodynamics, Vancouver (British Columbia)
(PB81-115974; SE-23; NOAA-80092208) Avail: NTIS HC A06/MF A01 CSCL 08G

Reports on commission activities, working groups and national committees are presented. The issue also contains summaries of Scientific Symposia; Messinian Correlation; Salinity Crisis; held Rome, Italy, October 9-11, 1978; Hawaii Symposium on intraplate and Submarine Volcanism; held Hilo, Hawaii, July 16-22, 1979; International Symposium on Rift Zones of the Earth; The Dead Sea Rift; held Jerusalem, Israel, September 10-20, 1979; Global Reconstructions and the Geomagnetic Field During the Paleozoic; held Canberra, Australia, December 2-15, 1979; and Dynamics of Plate Interiors; held Canberra, Australia, December 5, 1979. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-19511*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE REMOTE SENSING OF SNOWPACK PROPERTIES
Albert Rango, ed. 1980 272 p refs Conf. held at Fort Collins, Colo., 20-22 May 1980
(NASA-CP-2153) Avail: NTIS HC A12/MF A01 CSCL 08L

Topic concerning remote sensing capabilities for providing reliable snow cover data and measurement of snow water equivalents are discussed. Specific remote sensing technqiues discussed include those in the microwave region of the electromagnetic spectrum. For individual titles, see N81-19512 through N81-19525.

N81-19512*# Soil Conservation Service, Denver, Colo.
EVOLUTION OF SNOW SENSORS AND THE POTENTIAL OF MICROWAVE DEVICES IN OPERATIONAL TELEMETRY NETWORKS
Bernard A. Shafer *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 1-10 refs (For primary document see N81-19511 10-43)
Avail: NTIS HC A12/MF A01 CSCL 14B

Both manually collected snow-course data and telemetered information from SNOTEL sites throughout the western United States are used to make forecasts of streamflow. Although these conventional methods have proven highly reliable over the years, they still exhibit some shortcomings. Active and passive microwave remote sensing systems recently developed and tests present the potential to eliminate some negative aspects associated with other types of sensors currently in use. Because of their ability to see through the snowpack they offer a unique opportunity to improve snowpack measurement techniques. As yet neither the active nor passive system is developed sufficiently to supplant existing methods in operational telemetry networks. Active microwave sensors are the most promising for the near future

and are being used in research and development programs to study snow pillow performance in the SNOTEL system. E.D.K.

N81-19513*# California State Dept. of Water Resources, Sacramento.

CALIFORNIA'S TRANSITION FROM CONVENTIONAL SNOWPACK MEASUREMENTS TO A DEVELOPING REMOTE SENSING CAPABILITY FOR WATER SUPPLY FORECASTING

A. J. Brown and Ned Peterson *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 11-17 refs (For primary document see N81-19511 10-43)
Avail: NTIS HC A12/MF A01 CSCL 08H

California's Snow Survey Program and water supply forecasting procedures are described. A review is made of current activities and program direction on such matters as: the growing statewide network of automatic snow sensors; restrictions on the gathering hydrometeorological data in areas designated as wilderness; the use of satellite communications, which both provides a flexible network without mountaintop repeaters and satisfies the need for unobtrusiveness in wilderness areas; and the increasing operational use of snow covered area (SCA) obtained from satellite imagery, which, combined with water equivalent from snow sensors, provides a high correlation to the volumes and rates of snowmelt runoff. Also examined are the advantages of remote sensing; the anticipated effects of a new input of basin wide index of water equivalent, such as the obtained through microwave techniques, on future forecasting opportunities; and the future direction and goals of the California Snow Surveys Program. E.D.K.

N81-19514*# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

LIQUID DISTRIBUTION AND THE DIELECTRIC CONSTANT OF WET SNOW

S. C. Colbeck *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 21-39 refs (For primary document see N81-19511 10-43)
Avail: NTIS HC A12/MF A01 CSCL 08L

The mixing theory of Polder and Van Santen is revised for application to three cases of wet snow. The dielectric constant is calculated for a range of liquid contents and porosities. These calculated values compare favorably with experimental data for the two cases in which data available. The application to a snow cover with a heterogeneous distribution of liquid is discussed. The possibility of applying this theory the calculate the imaginary part of the dielectric constant must be explored further. Author

N81-19515*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MEASUREMENT OF LIQUID WATER CONTENT IN A MELTING SNOWPACK USING COLD CALORIMETER TECHNIQUES

Albert Rango, E. Bruce Jones (Resource Consultants, Inc.), and Steven Howell (Resource Consultants, Inc.) *In its* Microwave Remote Sensing of Snowpack Properties 1980 p 41-67 refs (For primary document see N81-19511 10-43)
(Contract NAS5-23815)
Avail: NTIS HC A12/MF A01 CSCL 08L

Liquid water in a snowpack is a quantifiable parameter of hydrological significance. It is also important in the interpretation of snowpack remote sensing data using microwave techniques. One acceptable approach to measuring liquid water content of a snowpack (by weight) is the cold calorimeter. This technique is presented from theory through application. Silicon oil was used successfully as the freezing agent. Consistent results can be obtained even when using operators with a minimum of training. Data can be obtained approximately every 15 minutes by using two calorimeters and three operators. Accuracy within one to two percent can be achieved under reasonable field conditions. E.D.K.

N81-19516*# Innsbruck Univ. (Austria).

THE DIELECTRIC BEHAVIOUR OF SNOW: A STUDY VERSUS LIQUID WATER CONTENT

W. Ambach and A. Denoth *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 69-92 refs (For primary document see N81-19511 10-43)
Avail: NTIS HC A12/MF A01 CSCL 08L

Snow is treated as a heterogeneous dielectric material consisting of ice, air, and water. The greater difference in the high frequency relative permittivity of dry snow and water allows to determine the liquid water content by measurements of the relative permittivity of snow. A plate condenser with a volume of about 1000 cu cm was used to measure the average liquid water content in a snow volume. Calibration was carried out using a freezing calorimeter. In order to measure the liquid water content in thin snow layers, a comb-shaped condenser was developed, which is the two dimensional analogon of the plate condenser. With this moisture meter the liquid water content was measured in layers of a few millimeters in thickness, whereby the effective depth of measurement is given by the penetration depth of electric field lines which is controlled by the spacing of the strip lines. Results of field measurements with both moisture meters, the plate condenser and the comb-shaped condenser, are given. E.D.K.

N81-19517*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SNOW ELECTROMAGNETIC MEASUREMENTS

William I Linlor, James L. Smith (U.S. Forest Service Berkeley, Calif.), Fred D. Clapp (California Univ., Berkeley), and Diogenes J. Angelakos (California Univ., Berkeley,.) *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 93-117 refs (For primary document see N81-19511 10-43)
(Contract NCA2-OR050-704)
Avail: NTIS HC A12/MF A01 CSCL 08L

An electromagnetic system is described for measuring the dielectric constant and attenuation of snow samples in the frequency range of 4 to 12 GHz. System components consists of a swept-frequency source, microwave horns, network analyzer, and XY plotter. The procedure for calibrating the effect of wetness on the snow properties is described. Equations are given that express the experimentally determined relation between attenuation per unit length and volume percent wetness at any frequency between 4 and 12 GHz. permittivity can be calculated from the snow density, attenuation per unit length, and frequency. Some applications of the techniques are described such as runoff forecasting from mountain snowpacks. E.D.K.

N81-19518*# Colorado State Univ., Fort Collins.

ACTIVE MICROWAVE WATER EQUIVALENCE

H. S. Boyne and D. A. Ellerbruch (NBS, Boulder, Colo.) *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 119-129 refs Sponsored in part by USDA Soil Conservation Service (For primary document see N81-19511 10-43)
Avail: NTIS HC A12/MF A01 CSCL 08H

Measurements of water equivalence using an active FM-CW microwave system were conducted over the past three years at various sites in Colorado, Wyoming, and California. The measurement method is described. Measurements of water equivalence and stratigraphy are compared with ground truth. A comparison of microwave, federal sampler, and snow pillow measurements at three sites in Colorado is described. E.D.K.

N81-19519*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

RADAR OBSERVATION OF SNOWPACKS

W. Herschel Stiles and Fawwaz T. Ulaby *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 131-146 refs (For primary document see N81-19511 10-43)
(Contract NAS5-23777)
Avail: NTIS HC A12/MF A01 CSCL 08L

Radar observations of snowpacks were made at test sites in Kansas, South Dakota, and Colorado using truck mounted scatterometers covering the 1 to 18 GHz frequency range and the atmospheric window frequency of 35 GHz. Experiments were conducted as a function of snow depth, wetness, and surface roughness. The acquired data were used to model the backscattering coefficient in terms of snow and underlying soil parameters. The results indicate that the radar return (1) increase with increasing water equivalent; (2) decrease with increasing wetness; (3) is sensitive to the snow surface roughness only when the

snow is wet; (4) is sensitive to the state (frozen or thawed) of the underlying soil if the snow is dry; and (5) is repetitive from one site to another and from one season to the next. Additionally, the measurements indicate the multifrequency observation or day-night observations may potentially provide the means for monitoring snow water equivalent, snow wetness, and the soil state. E.D.K.

N81-19520*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.

THEORETICAL MODELS FOR MICROWAVE SNOW RESPONSE AND APPLICATIONS TO REMOTE SENSING

J. A. Kong, R. Shin, S. L. Chuang, and L. Tsang *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 147-167 refs (For primary document see N81-19511 10-43)

(Contracts NAG5-16; F19628-80-C-0052; Grant NSF ENG-78-23145)

Avail: NTIS HC A12/MF A01 CSCL 08L

Two theoretical models were developed to characterize snowpacks: (1) a random medium with a variance, a horizontal correlation length, and a vertical correlation length; and (2) a homogeneous dielectric containing discrete scatters. Theoretical results were matched with experimental data collected from snow ice fields. For snow ice fields the horizontal correlation length is no less than the vertical correlation length signifying a more laminar structure. The correspondence between the continuum random medium and the discrete spherical scatter model can be verified when the vertical correlation length is equal to the horizontal correlation length. The vertically polarized backscattering cross section sigma (sub vv) is always greater than the horizontally polarized backscattering cross section sigma (sub hh) for half space scattering media and may become smaller for a two layer model. In order to account for diurnal change exhibited by snow fields in both the active and passive remote sensing cases, a three layer model with a thin top layer caused by solar illumination must be used. E.D.K.

N81-19521*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Earth Survey Applications Div.

REMOTE SENSING OF SNOW PROPERTIES BY PASSIVE MICROWAVE RADIOMETRY: GSFC TRUCK EXPERIMENT

A. T. C. Chang, Albert Rango, and J. C. Shiue *In its* Microwave Remote Sensing of Snowpack Properties 1980 p 169-185 refs (For primary document see N81-19511 10-43)

Avail: NTIS HC A12/MF A01 CSCL 08L

Recent results indicate that microwave radiometry has the potential for inferring the snow depth and water equivalent information from snowpacks. In order to assess this potential for determining the water equivalent of a snowpack, it is necessary to understand the microwave emission and scattering behavior of the snow at various wavelengths under carefully controlled conditions. Truck-mounted microwave instrumentation was used to study the microwave characteristics of the snowpack in the Colorado Rocky Mountain region during the winters of 1977 to 78 and 7978 to 79. The spectral signatures of C, X, K sub u, and K sub a band radiometers with dual polarization were used, together with measurements of snowpack density, temperature an ram profiles, liquid water content, and rough characterization of the crystal sizes. These data compared favorably with calculated results based on recent microscopic scattering models. Author

N81-19522*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

MICROWAVE RADIOMETRIC OBSERVATIONS OF SNOWPACKS

Fawwaz T. Ulaby and W. Herschel Stiles *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 187-201 refs (For primary document see N81-19511 10-43)

(Contract NAS5-23777)

Avail: NTIS HC A12/MF A01 CSCL 08L

Models for the microwave emission from snowpacks were generated on the basis of radiometric observations made at 10.7 GHz, 37 GHz, and 94 GHz at a test site near Steamboat Springs, Colorado. In addition to conducting measurements on an approximately daily basis over a six week observation period, measurements were made over several diurnal cycles during which the change in snow wetness was tracked by the microwave radiometers. Also, the variation in emissivity with snow water equivalent was examined, as was the sensitivity to changes in snow surface geometry. The microwave emissivity was observed to (1) decrease exponentially with snow water equivalent and (2) increase with snow wetness. Thus, the emission behavior is the reverse of the backscattering behavior observed by the radar. By fitting the models to the measured data, the variation of the optical depth with snow wetness was estimated. Author

N81-19523*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MICROWAVE SIGNATURES OF THE NATURAL SNOW COVER AT WEISSFLUHJOCH

R. Hofer, C. Maetzler (Inst. of Applied Physics, Bern), E. Schanda (Inst. of Applied Physics, Bern), and W. Good (Swiss Federal Inst. for Snow and Avalanche Res., Weissfluhjoch) *In* NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 203-223 refs (For primary document see N81-19511 10-43)

Avail: NTIS HC A12/MF A01 CSCL 08L

The natural snow cover on a high altitude alphine test site was monitored with a multi-frequency radiometer for more than three years. Some measurements were also made with a 10.5 GHz scatterometer. The microwave observations are supported by a large set of ground truth data. From year to year a wide variation in the development of the snowpack above and below average was observed. Typical microwave data are presented for the different snow conditions in view of the applicability as signatures for remote sensing. E.D.K.

N81-19524*# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

THEORETICAL AND EXPERIMENTAL STUDIES OF MICROWAVE RADIATION FROM A NATURAL SNOW FIELD

Martti Tiuri and Henrik Schultz IN NASA. Goddard Space Flight Center Microwave Remote Sensing of Snowpack Properties 1980 p 225-234 refs (For primary document see N81-19511 10-43)

Avail: NTIS HC A12/MF A01 CSCL 08L

The brightness temperature of a natural snow field in northern Europe was studied theortically and experimentally at 5, 12, and 37 GHz for satellite remote sensing applications. A snow model consisting of ice spheres covered by a water shell was used in calculation, taking into account scattering and absorption. The brightness temperature of a natural snow field as a function of view angle was measured from a tower in 1978 and 1979. The measured brightness temperature curves can be fitted with calculated ones by assuming reasonable values for the wetness and the particle size of snow. Experimental results also show that relatively small changes in the snow conditions cause large changes in the brightness temperature. In order to obtain a more controlled situation, experiments were continued in 1980 using a measuring site covered with aluminum sheets and determining the wetness and the particle size in addition to the density and physical temperature. E.D.K.

N81-19525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Earth Survey Applications Div.

MONITORING SNOWPACK PROPERTIES BY PASSIVE MICROWAVE SENSORS ON BOARD OF AIRCRAFT AND SATELLITES

A. T. C. Chang, J. L. Foster, D. K. Hall, and Albert Rango *In its* Microwave Remote Sensing of Snowpack Properties 1980 p 235-248 refs (For primary document see N81-19511 10-43)

Avail: NTIS HC A12/MF A01 CSCL 08L

Snowpack properties such as water equivalent and snow wetness may be inferred from variations in measured microwave brightness temperatures. This is because the emerged microwave radiation interacts directly with snow crystals within the snowpack. Using vertically and horizontally polarized brightness temperatures obtained from the multifrequency microwave radiometer (MFMR) on board a NASA research aircraft and the electrical scanning microwave radiometer (ESMR) and scanning multichannel microwave radiometer (SMMR) on board the Nimbus 5, 6, and

7 satellites, linear relationships between snow depth or water equivalent and microwave brightness temperature were developed. The presence of melt water in the snowpack generally increases the brightness temperatures, which can be used to predict snowpack priming and timing of runoff. Author

N81-19526*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEASAT ALTIMETER HEIGHT CALIBRATION
Ronald Kolenkiewicz and Chreston F. Martin (EG and G Washington Analytical Services Center, Inc., Riverdale, Md.) Mar. 1981 42 p refs Submitted for publication
(NASA-TM-82040) Avail: NTIS HC A03/MF A01 CSCL 05B

The Seasat altimeter was calibrated for height bias using four overflight passes of Bermuda which were supported by the Bermuda laser. The altimeter data was corrected for: tides, using recorded tide gauge data; propagation effects, using meteorological data taken around the time of each pass; acceleration lag; and sea state bias, including both surface effects and instrumental effects. Altimeter data for each of the four passes was smoothed and extrapolated across the island. Interpolation between passes then produced an equivalent altimeter measurement to the geoid at the laser site, so that the altimeter bias could be estimated without the use of a geoid model. The estimated height bias was 0.0 + or - 0.07. J.M.S.

N81-19527*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL INFRARED REMOTE SENSING OF SURFACE FEATURES FOR RENEWABLE RESOURCE APPLICATIONS
Jean E. Welker Jan. 1981 29 p refs
(NASA-TM-82106) Avail: NTIS HC A03/MF A01 CSCL 08B

The subjects of infrared remote sensing of surface features for renewable resource applications is reviewed with respect to the basic physical concepts involved at the Earth's surface and up through the atmosphere, as well as the historical development of satellite systems which produce such data at increasingly greater spatial resolution. With this general background in hand, the growth of a variety of specific renewable resource applications using the developing thermal infrared technology are discussed, including data from HCMM investigators. Recommendations are made for continued growth in this field of applications. Author

N81-19528*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UTILIZATION OF REMOTE SENSING IN ALASKA PERMAFROST STUDIES
Dorothy K. Hall Feb. 1981 14 p refs Proposed for presentation at IEEE Geosci. and Sensing Soc., Washington, D.C., 8-10 Jun. 1981
(NASA-TM-82084) Avail: NTIS HC A02/MF A01 CSCL 08G

Permafrost related features such as: aufeis, tundra, thaw lakes and subsurface ice features were studied. LANDSAT imagery was used to measure the extent and distribution of aufeis in Arctic Slope rivers over a period of 7 years. Interannual extent of large aufeis fields was found to vary significantly. Digital LANDSAT data were used to study the short term effects of a tundra fire which burned a 48 sq km area in northwestern Alaska. Vegetation regrowth was inferred from Landsat spectral reflectance increases and compared to in-situ measurements. Aircraft SAR (Synethic Aperture Radar) imagery was used in conjunction with LANDSAT imagery used in conjunction with LANDSAT imagery to qualitatively determine depth categories for thaw lakes in northern Alaska. T.M.

N81-19529*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON DATA FOR SEASAT ALTIMETRY IN THE WESTERN NORTH ATLANTIC
R. E. Cheney Jan. 1981 23 p refs Submitted for publication
(NASA-TM-82069) Avail: NTIS HC A02/MF A01 CSCL 05B

The radar altimeter flown on Seasat in 1978 collected approximately 1,000 orbits of high quality data (5-8 precision). In the western North Atlantic these data were combined with a detailed gravimetric geoid in an attempt to produce profiles of dynamic topography. In order to provide a basis for evaluation of these profiles, available oceanographic observations in the Gulf Stream/Sargasso Sea region have been compiled into a series of biweekly maps. The data include XBT's, satellite infrared imagery, and selected trajectories of surface drifters and sub-surface SOFAR floats. The maps document the known locations of the Gulf Stream, cyclonic and anticyclonic rings, and mid-ocean eddies during the period July to October 1978. T.M.

N81-19530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY EVIDENCE FOR THE INFLUENCE OF PHYSIOGRAPHY AND SCALE UPON THE AUTOCORRELATION FUNCTION OF REMOTELY SENSED DATA
M. L. Labovitz, D. L. Toll, and R. E. Kennard Dec. 1980 36 p refs Submitted for publication
(NASA-TM-82064) Avail: NTIS HC A03/MF A01 CSCL 05B

Previously established results demonstrate that LANDSAT data are autocorrelated and can be described by a univariate linear stochastic process known as auto-regressive-integrated-moving-average model of degree 1, 0, 1 or ARIMA (1, 0, 1). This model has two coefficients of interest for interpretation phi(1) and theta(1). In a comparison of LANDSAT thematic mapper simulator (TMS) data and LANDSAT MSS data several results were established: (1) The form of the relatedness as described by this model is not dependent upon system look angle or pixel size. (2) The phi(1) coefficient increases with decreasing pixel size and increasing topographic complexity. (3) Changes in topography have a greater influence upon phi(1) than changes in land cover class. (4) The theta(1) seems to vary with the amount of atmospheric haze. These patterns of variation in phi(1) and theta(1) are potentially exploitable by the remote sensing community to yield stochastically independent sets of observations, characterize topography, and reduce the number of bytes needed to store remotely sensed data. Author

N81-19531*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALBEDO AND FLUX EXTINCTION COEFFICIENT OF IMPURE SNOW FOR DIFFUSE SHORTWAVE RADIATION
B. J. Choudhury, T. Mo, J. R. Wang, and A. T. C. Chang Feb. 1981 15 p refs Submitted for publication Prepared in cooperation with Computer Sciences Corp., Silver Spring, Md. (Contract NAS5-24350)
(NASA-TM-82080) Avail: NTIS HC A02/MF A01 CSCL 08L

Impurities enter a snowpack as a result of fallout of scavenging by falling snow crystals. Albedo and flux extinction coefficient of soot contaminated snowcovers were studied using a two stream approximation of the radiative transfer equation. The effect of soot was calculated by two methods: independent scattering by ice grains and impurities and average refractive index for ice grains. Both methods predict a qualitatively similar effect of soot; the albedo is decreased and the extinction coefficient is increased compared to that for pure snow in the visible region; the infrared properties are largely unaffected. Quantitatively, however, the effect of soot is more pronounced in the average refractive index method. Soot contamination provides a qualitative explanation for several snow observations. T.M.

N81-19532*# Virginia Polytechnic Inst., Blacksburg.
GENERAL DESCRIPTION AND OPERATION OF THE AGRO-ENVIRONMENTAL SYSTEM: CROP MANAGEMENT MODELING
Ernest Gross and J. H. Scott, Jr. Mar. 1981 35 p (Contract NAS6-2388)
(NASA-CR-156874) Avail: NTIS HC A03/MF A01 CSCL 02C

Input for a data management system to provide farmers with information to improve crop management practices in Virginia requires monitoring of control crops at field stations, crop surveys derived from remotely sensed aircraft data, meteorological data from synchronous satellites, and details of local agricultural conditions. Presently models are under development for determining pest problems, water balance in the soil, stages of plant

maturity, and optimum planting date. The status of the Cerospora leafspot model for peanut crop management is considered. Other models under development planned relate to Cylindtocladium Balckrot and Sclerotinia blight of peanuts, cyst nematode (Globerdena solanacearum) of tobacco, and red crown rot of soybeans. A software for program for estimating precipitation and solar radiation on a statewise basis is also being developed. A.R.H.

N81-19533# Susquehanna Resources and Environment, Inc., Johnson City, N.Y.
COMPARATIVE EVALUATIONS OF THE RADC/HSU TEXTURE MEASUREMENT SYSTEM WITH PERCEPTUAL ANALYSIS Final Report
Shin-yi Hsu and Richard G. Burright Oct. 1980 50 p refs
(Contract F49620-79-C-0009; AF Proj. 2313)
(AD-A094416; AFOSR-81-0079TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Aspects of the enormously important pattern recognition problem were examined. Real world, digitized image information from high and low resolution aerial photographs of different and similar terrain types was used. We compared human judgments of overall visual differences among chloropleth representations with computer solutions based on the RADC/Hsu system. The work has resulted in new methodological and theoretical perspectives (including Master's scaling technique) which provide means for better defining and understanding both human and computer information handling systems when highly complex, remotely sensed, real world data are involved. GRA

N81-19534# Applied Science Technology, Inc., Arlington, Va.
FEASIBILITY STUDY OF AIRBORNE BATHYMETRIC SENSING USING THE CO2 LASER/ ACOUSTIC TECHNIQUE (BRIGHTON DAM TEST RESULTS) Interim Report, Sep. 1978 - Nov. 1979
G. Daniel Hickman, B. S. Maccabee (Naval Surface Weapons Center), and C. E. Bell (Naval Surface Weapons Center) May 1980 39 p refs
(AD-A094694; AST-R-070580) Avail: NTIS HC A03/MF A01 CSCL 08/10

A feasibility experiment was performed on a concept for a remote system for bathymetric mapping in turbid shallow waters. The concept consists of a CO2 laser transmitter and a microphone receiver. The CO2 laser is used from a platform in the air to generate an acoustic field in the water, while the microphone (in air) detects the sound pulses, after being reflected off the bottom sediment. The results of these experiments definitively proved that the CO2 laser/acoustic technique could be used to derive bathymetric data using a microphone located in the air. The possibility therefore exists that this technique could be used as the basis for a remote sensing system for shallow water bathymetry. Similar type measurements were also made of acoustic reflections from an aluminum plate located at various water depths. Calculations of the Sound Pressure Levels (SPL) are in good agreement with SPL's measured with a hydrophone in the water. However, large discrepancies exist between measured and calculated SPL's with the Air-located microphone. The resolution of these discrepancies, which are thought to be due to a malfunction of the microphone, will be one of the objectives of future experiments. GRA

N81-19535# Defense Nuclear Agency, Washington, D.C.
DEFENSE MAPPING AGENCY INERTIAL POSITIONING SYSTEM TEST RESULTS (2ND)
Harry C. Harris Nov. 1980 14 p refs Presented at the 16th FIG Intern. Cong., Montreux, Switzerland, 9-18 Aug. 1980
(AD-A094738) Avail: NTIS HC A02/MF A01 CSCL 08/2

In 1979, the U.S. Defense Mapping Agency received its second inertial surveying system, which was built for DMA by Honeywell, Inc. The system has undergone extensive field testing in both a vehicle and a helicopter. This paper describes the system, details the field test procedures, and describes the results that have been obtained with this new system. The operational evaluation of the system includes many static and dynamic tests under various conditions and scenarios, designed to answer the classical questions such as effect of length of travel time between zero velocity updates and between survey update points, value of single versus double runs, sensitivity to directional changes, and comparison of results obtained in a vehicle and a helicopter. GRA

N81-19536# Defense Mapping Agency, Washington, D.C. Advanced Technology Div.
RESEARCH AND DEVELOPMENT ITEMS AT THE DEFENSE MAPPING AGENCY (DMA)
Robert A. Penny 10 Dec. 1980 32 p
(AD-A094935) Avail: NTIS HC A03/MF A01 CSCL 08/2

This report covering significant Research and Development (R&D) activities of the Defense Mapping Agency (DMA) is prepared on an annual basis. The following general functional areas are covered in the report: (1) Geodesy and Geophysics; (2) Hydrography; (3) Elevation Data Collection; (4) Feature Analysis. GRA

N81-19537# Image Graphics, Inc., Fairfield, Conn.
DEVELOPMENT OF HIGH SPEED CRT PRINT HEAD SYSTEMS FOR CARTOGRAPHIC APPLICATIONS Final Technical Report, Jun. 1978 - Feb. 1980
Patrick F. Grosso 15 Feb. 1980 50 p refs
(Contract DAAG53-76-C-0182)
(AD-A095157; Rept-3001; ETL-0213) Avail: NTIS HC A03/MF A01 CSCL 14/5

The CRT 2000 Print Head System is a high speed, large format, flatbed plotter photocomposition system developed for the Defense Mapping Agency (DMA) to produce color separation film masters for maps and charts from digital names/symbols and cartographic data. The color separations are used to prepare press-ready printing plates for conventional multi-color printing presses for the printing of color charts and maps. Three engineering models of CRT 2000 Print Heads were developed, installed and integrated with government owned Plotter Tables at the Defense Mapping Agency's Hydrographic, Topographic and Aerospace Centers located in Washington, D.C. and St. Louis, Mo. respectively. GRA

N81-19538# Oak Ridge National Lab., Tenn.
COMPUTATION OF THE VELOCITY FIELD AND MASS BALANCE IN THE FINITE ELEMENT MODELING OF GROUNDWATER FLOW
G. T. Yeh 1980 23 p refs Presented at Symp. on Modeling and Low Level Waste Management, Denver, 1 Dec. 1980
(Contract W-7405-eng-26)
(CONF-801217-2) Avail: NTIS HC A02/MF A01

Darcian velocity was conventionally calculated in the finite element modeling of groundwater flow by taking the derivatives of the computed pressure field. This results in discontinuities in the velocity field at nodal points and element boundaries. Discontinuities become enormous when the computed pressure field is far from a linear distribution. It is proposed that the finite element procedure that is used to simulate the pressure field or the moisture content field also be applied to Darcy's law with the derivatives of the computed pressure field as the load function. The problem of discontinuity is then eliminated, and the error of mass balance over the region of interest is much reduced. DOE

N81-19539# Sandia Labs., Albuquerque, N. Mex.
STRATEGIC PETROLEUM RESERVE DATA ACQUISITION SYSTEM
P. D. Merillat and A. G. Bauer Oct. 1980 180 p
(Contract DE-AC04-76DP-00789)
(SAND-80-2143) Avail: NTIS HC A09/MF A01

The Strategic Petroleum Reserve Data Acquisition System is a general purpose, digital data acquisition system designed for field use in DOE's Strategic Petroleum Reserve testing and monitoring program. The system is computer driven, under the control of an operator. The system is designed to allow the operator to perform pre-test system configuration; test monitoring and control; and post test analysis. This document is a system description and an operator users manual. Topics covered include: configuration and running on-line tests, software documentation, and maintenance programming information. DOE

N81-19540# Science Applications, Inc., McLean, Va.
HEAVY OIL RESERVOIRS RECOVERABLE BY THERMAL TECHNOLOGY Annual Report

Patrick Kujawa Feb. 1981 339 p refs Prepared in cooperation with DOE, Oakland, Calif.
(Contract DE-AC03-78ET-12380)
(DOE/ET-12380/1-Vol-3) Avail: NTIS HC A15/MF A01

Reservoir, production, and project data are presented for target reservoirs thermally recoverable by steam drive which are equal to or greater than 2500 feet deep and contain heavy oil in the 8 to 25(0) API gravity range. Data were sought depicting and characterizing individual reservoirs as opposed to data covering an entire field with more than one producing interval or reservoir. DOE

N81-19541# North Carolina Univ., Chapel Hill. Dept. of Geology.
PEAT RESOURCES OF NORTH CAROLINA Annual Report
Lee J. Otte and Ray L. Ingram Nov. 1980 65 p
(Contract DE-AC01-79ET-146933)
(DOE/ET-14693/T1) Avail: NTIS HC A04/MF A01

Peat deposits of North Carolina are of three main geological types representing the accumulation of organic matter in: pocosins - broad shallow depressions on an uplifted sea floor, river flood plains, and Carolina Bays - elliptical depressions of unknown origin. Pocosin deposits normally range in thickness from 1 to 8 feet. River flood plain peats are of unknown extent. They occur as lenses in alluvial sands and clays and may attain thickness of 20 feet. The ash content usually exceeds 10 percent. Five to six hundred Carolina Bays from 0.2 to 3 miles in length are scattered over the Coastal Plain. DOE

N81-19542# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.
ON THE STABILITY OF NORTHERN HEMISPHERE CONTINENTAL ICE SHEETS
J. Oerlemans 1980 16 p refs
(KNMI-WR-80-2) Avail: NTIS HC A02/MF A01

The behavior of large continental ice sheets under various climatic conditions is discussed. The feedback between ice sheet height and mass balance is analytically determined considering ice sheets with perfect plastic behavior. The analysis suggests that three characteristic situations exist for warm, moderate, and cold climatic conditions, respectively. It is concluded that ice sheets respond strongly nonlinearly to quasi-periodic variations in insolation. The theoretical results are supported by the analysis of a deep sea core, which shows unimodal distribution of parameters directly related to sea-surface temperature, and bimodal distribution of oxygen isotope ratios, which are related to ice volume on Earth. Author (ESA)

N81-19543# Technical Research Centre of Finland, Espoo. Lab. of Land Use.
THE USE OF SATELLITE IMAGERY IN SEA-ICE MONITORING
Sipi Jaakkola Jun. 1979 49 p refs In FINNISH; ENGLISH summary
(VTT-LU-27; ISBN-951-38-0903-X; ISSN-0355-3477) Avail: NTIS HC A03/MF A01

The possibilities of sea-ice monitoring using available satellite imagery were examined for the Gulf of Bothnia area. The state of the art of remote sensing techniques for sea-ice monitoring is reviewed. The installation of a Tiros-N satellite data receiving station is suggested as an immediate solution to the monitoring problem, and the required facilities are described. Certain principles for a long term solution are presented. Author (ESA)

N81-19544# Committee on Space Research (COSPAR), Berne (Switzerland).
SPACE RESEARCH IN SWITZERLAND, 1979 Annual Report
1979 23 p
Avail: NTIS HC A02/MF A01

Efforts in satellite geodesy, studies of the middle atmosphere and magnetosphere, solar wind research, and investigation of noble gases in lunar materials are reported. Work on solar flares, the solar constant, optical and radio astronomy observations, and Earth resource studies including digital classification of data and analog processing of imagery from LANDSAT are reviewed. Activities involving BIORACK, and exobiology are listed. Author (ESA)

N81-19545# Zeiss (Carl), Oberkochen (West Germany). Abt. fuer Geodaesie und Photogrammetrie.
INNOVATIONS IN INSTRUMENTATION FOR GEODESY AND PHOTOGRAMMETRY Final Report
Dierk Hans-Karsten Hobbie, Ernst Michelbacher, and Rainer Schwebel Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 56 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-129; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11,80

The performance and efficiency of photogrammetric and surveying instruments are shown significantly improved by the use of modern electronic components. Examples of electronics applications in surveying equipment cover electrooptical range finders, digital circle reading, data processing by means of microprocessors, and recording of measured data. The most important examples in the photogrammetric field are computer assistance and computer control of the instruments. Information is given on instrument designs which take advantage of these developments. Author (ESA)

N81-19546# Geological Survey, Helena, Mont. Water Resources Div.
STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA THROUGH 1976 Final Water-Resources Investigations Report
L. Grady Moore and Ronald R. Shields Jul. 1980 75 p refs Prepared in cooperation with Montana Dept. of Natural Resources and Conservation, Helena
(PB81-120859; USGS/WRD/WRI-80/070; USGS/WRI-80-41) Avail: NTIS HC A04/MF A01 CSCL 08H

Statistical summaries of stream flow data for selected stream gaging and crest stage gage sites are presented to aid in appraising the hydrology of the Yellowstone River basin. Stream flow records are presented for 45 gaging stations and 45 crest gages for the period of record. For each gaging station selected, a brief description is given for station location, drainage area, period of record, revisions of previously published records, type and history of gages, regulation and diversions, and extremes of discharge. These data are followed by tables of monthly and annual flow statistics, high flow and low flow frequency data, flood frequency data, flow duration information, and for natural flow sites selected basin characteristics. GRA

N81-19547# Connecticut Univ., Storrs.
INVESTIGATION OF A SURFACE RESISTIVITY TECHNIQUE FOR THE ESTIMATION OF HYDRAULIC CONDUCTIVITY IN STRATIFIED DRIFT AQUIFERS M.S. Thesis
David Scott 1980 110 p refs
(Contract DI-14-34-0001-7014)
(PB81-120594; W81-00267; OWRT-A-077-CONN(3)) Avail: NTIS HC A06/MF A01 CSCL 08H

A least squares regression line correlating hydraulic conductivity with apparent formation factor of aquifers in sand and gravel (generally thought to be stratified drift in the cases discussed) is presented. Nineteen aquifers in southern New England were studied. Schlumberger vertical electrical soundings (VES) were conducted at water well sites for which pump test data were available. Methods for the interpretation of pump test data from water table and leaky artesian aquifers are discussed. The ratio of vertical to horizontal hydraulic conductivity averaged one to twenty seven in the aquifers studied. GRA

N81-19548# Geological Survey, Tacoma, Wash. Water Resources Div.
SEMI-VARIOGRAM ESTIMATION AND UNIVERSAL KRIGING PROGRAM (COMPUTER PROGRAM) DOCUMENTATION USER'S MANUAL
James A. Skrivan Apr. 1980 103 p refs
(PB81-120560; USGS/WRD/WRI-80/064) Avail: NTIS HC A06/MF A01 CSCL 08B

Computer program K603 contains procedures needed in the stochastic-interpolation algorithm known as universal kriging, as

originally described by G. Matheron. By specifying a theoretical semivariogram and functional terms of an assumed underlying trend (or drift) kriging provides unbiased estimates of variables in neighborhoods of autocorrelation. Given single observations and their spatial distribution in two dimensions, the technique yields point estimates and point estimate variances at arbitrary locations. In the absence of measurement errors, which can be incorporated in the analysis, kriging is an exact interpolator. The program includes four options used in kriging: (1) semivariogram estimation; (2) universal kriging for optimization of the drift semivariogram set; (3) universal kriging for arbitrary point or block estimation; and (4) universal kriging for drift coefficient estimation. GRA

N81-19549# Gates (W. E.) and Associates, Inc., Batavia, Ohio.
AN ASSESSMENT OF NONPOINT SOURCE TECHNOLOGY FOR WATER RESOURCE MANAGEMENT IN URBANIZING AREAS
Sep. 1980 75 p refs
(PB81-118788; W81-00191; OWRT-C-90226-G(9626)(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

Fourteen comprehensive models of the nonpoint source process were reviewed, and their spacetime characteristics and component processes described. With only one exception, comprehensive model components were empirical or deterministic, with the current trend being the use of deterministic relationships. Also, there appeared to be a trend towards greater incorporation of spatial characteristics in more recent models. Historically, nonpoint source research were segregated into three areas: urban analysis; sediment modeling; and chemical modeling. GRA

N81-19550# Gates (W. E.) and Associates, Inc., Batavia, Ohio.
TECHNOLOGY ASSESSMENT OF HYDROLOGY FOR WATER RESOURCE MANAGEMENT IN URBANIZING AREAS
Sep. 1980 79 p refs
(PB81-118754; W81-00192; OWRT-C-90226-T(9626)(1)) Avail: NTIS HC A05/MF A01 CSCL 08H

The historical development of rainfall runoff models is discussed with emphasis placed on the evolution of the models and their responsiveness to the changing spatial requirements in rainfall runoff and nonpoint source modeling. Model development occurs through an iterative process involving phenomenological, statistical-empirical, and deterministic, model forms. Rainfall runoff modeling is currently in a stage in the iterative development process between two phenomenological models. All operational rainfall runoff models are largely based on the outdated Horton model, while broadbased general acceptance has occurred for the spatially-based Hewlett model. GRA

N81-19551# Stormwater Consultants, Bolingbrook, Ill.
STORMWATER MANAGEMENT IN THE UNITED STATES. A STUDY OF INSTITUTIONAL PROBLEMS, SOLUTIONS AND IMPACTS
Herbert G. Poertner Sep. 1980 250 p refs
(Contract DI-14-311-0001-4235)
(PB81-121048; W81-00263; OWRT-C-5239(4235)(1)) Avail: NTIS HC A11/MF A01 CSCL 08H

Personal interviews were conducted in many urban and metropolitan areas of the United States to investigate institutional problems in stormwater management. Successful solutions and the impacts and transferability of solutions were studied in detail. The objective was to prepare a report useful to local public officials and management personnel in developing and operating effective, economical and timely programs and facilities for managing stormwater. The studies addressed the broad field of stormwater management, including both 'control' and 'developmental' activities. GRA

N81-19552# National Environmental Satellite Service, Washington, D. C. Environmental Sciences Group.
IMPROVED ALGORITHM FOR CALCULATION OF UTM AND GEODETIC COORDINATES
Jeff Dozier Sep. 1980 27 p refs
(PB81-132680; NOAA-TR-NESS-81; NOAA-80101501) Avail: NTIS HC A03/MF A01 CSCL 08E

Expression of the equations for a Universal Transverse Mercator (UTM) (Gauss-Kruger) projection in terms of Jacobian elliptic functions, rather than their series expansions, allows the projection to be used over wider zones than the standard 6 deg strips, and thus makes it applicable to satellite data from the NOAA A-G series. An efficient iterative solution method for either UTM or geodetic coordinates is developed using a complex arithmetic version of Newton's method. The method can be used for longitudes up to 90 deg from the central meridian. GRA

N81-19553# Institute of Gas Technology, Chicago, Ill.
ANALYSIS OF GEOPRESSURED AQUIFERS Annual Report, 1979
Mark G. Doherty Jun. 1980 64 p refs
(PB81-123416; GRI-79/0040) Avail: NTIS HC A04/MF A01 CSCL 08I

The purpose of this project is to assemble data to analyze the possibility of natural gas production from watered-put geopressured gas cap wells and hydropressured aquifers. The technical and economic feasibility of hydraulically fracturing a tight geopressured aquifer to increase reservoir permeability as well as gas production were examined. GRA

N81-19554# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
MONITORING IN THE VADOSE ZONE: A REVIEW OF TECHNICAL ELEMENTS AND METHODS
L. G. Wilson Jun. 1980 186 p refs
(Contract EPA-V-0591-NALX)
(PB81-125817; EPA-600/7-80-134) Avail: NTIS HC A09/MF A01 CSCL 08H

The topics of principles of pollutant movement in the vadose zone (zone of aeration or unsaturated zone), basic chemical reactions of fluids in the zone, state of the art monitoring techniques; and the relative advantages and disadvantages of the different monitoring techniques are covered. Concern over hazardous waste disposal has indicated the need for instruction on how to monitor in the vadose zone and to identify the potential gains from the limitations of the methods available for monitoring in this zone. Technical information needed by regulating agencies and industrial concerns in dealing with waste disposal problems are provided. GRA

N81-19555# Geological Survey, Trenton, N. J. Water Resources Div.
COMPUTER-MODEL ANALYSIS OF THE USE OF DELAWARE RIVER WATER TO SUPPLEMENT WATER FROM THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM IN SOUTHERN NEW JERSEY Final Report
Arlen W. Harbaugh, James E. Luzier, and Flavian Stellerine May 1980 49 p refs Prepared in cooperation with Delaware River Basin Commission
(PB81-123259; USGS/WRD/WRI-80/072; USGS/WRI-80-31) Avail: NTIS HC A03/MF A01 CSCL 08H

A computer model of the Potomac-Raritan-Magothy aquifer system was used to simulate the effects of supplementing ground water with water from the Delaware River. Replacement of ground water pumpage with surface water in a 150 square mile area near Camden, N.J., was simulated. Artificial recharge of surface water was also simulated in the same area. A series of nine simulations was made. The simulations include the period 1974 to 2000. Two projections for water use were used. Also, in some of the model simulations a line of injection wells was simulated to prevent movement of saline water into pumping centers. GRA

N81-19556# Colorado State Univ., Fort Collins.
APPLICATIONS OF REMOTE SENSING IN HYDROLOGY
William D. Striffler and Diana C. Fitz Sep. 1980 89 p refs
(Contract DI-14-34-0001-7145)
(PB81-127425; W81-00505; COMPLETION-99; OWRT-B-160-COL(7)) Avail: NTIS HC A05/MF A01 CSCL 08H

Potential applications of remote sensing in the field of hydrology are considered. The physical principles of electromagnetic energy and many of the available sensors are described. Operational uses and research applications of remote sensing in areas related to watershed management are summarized. GRA

N81-19557# National Oceanic and Atmospheric Administration, Rockville, Md.
PLANNING FOR A CIVIL OPERATIONAL LAND REMOTE SENSING SATELLITE SYSTEM: A DISCUSSION OF ISSUES AND OPTIONS
20 Jun. 1980 130 p
(PB81-130338; NOAA-80101702) Avail: NTIS HC A07/MF A01 CSCL 08C

The issues involved in implementing an operational land remote sensing system from space, initially based on LANDSAT technology are presented. The goal of eventual private sector ownership and operation of the system is emphasized. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-19558* National Aeronautics and Space Administration. Pasadena Office, Calif.
COPPER DOPED POLYCRYSTALLINE SILICON SOLAR CELL Patent
Krishna M. Koliwad (JPL, California Inst. of Tech., Pasadena) and Taher Daud, inventors (to NASA) (JPL, California Inst. of Tech., Pasadena) Issued 10 Feb. 1981 4 p Filed 30 May 1979 Supersedes N79-25512 (17 - 16, p 2147)
(NASA-Case-NPO-14670-1; US-Patent-4,249,957; US-Patent-Appl-SN-043941; US-Patent-Class-136-258; US-Patent-Class-357-30; US-Patent-Class-357-59; US-Patent-Class-357-63; US-Patent-Class-252-62.3E) Avail: US Patent and Trademark Office CSCL 10A

Fabrication of improved performance photovoltaic cells is described. They are fabricated from polycrystalline silicon containing copper segregated at the grain boundaries. T.M.

N81-19559* National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Oct. 1980 545 p
(NASA-SP-7043(27)) Avail: NTIS HC A23/MF A01 CSCL 10B

This bibliography lists 1920 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System from July 1, 1980 through September 30, 1980. Author

N81-19560 Cornell Univ., Ithaca, N. Y.
ELECTRICAL CHARACTERIZATION OF GRAIN BOUNDARIES IN GALLIUM ARSENIDE AND THEIR RELATIONSHIP TO SOLAR CELL PERFORMANCE Ph.D. Thesis
Michael Gregg Spencer 1980 128 p
Avail: Univ. Microfilms Order No. 8103000

To gain a better understanding of the electrical properties of grain boundaries and how they affect the performance of solar cells, the properties of very large grained polycrystalline material were studied. Studied were: the current versus voltage characteristic; the capacitance versus position characteristic; and the photoluminescence versus position characteristic of these grain boundaries. Deep level transient spectroscopy was used to study grain boundaries. From these measurements, the barrier height, doping, and interface state density of these grain boundaries were obtained. Dissert. Abstr.

N81-19561*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED THERMIONIC ENERGY CONVERTERS Patent Application
James F. Morris, inventor (to NASA) Filed 19 Feb. 1981 11 p
(NASA-Case-LEW-12443-1; US-Patent-Appl-SN-235797) Avail: NTIS HC A02/MF A01 CSCL 10A

The efficiency of thermionic energy converters is improved by reducing plasma losses. This is achieved by internal distribution of tiny shorted cesium diodes driven by the thermal gradient between the primary emitter and the collector. The tiny, shorted diode distribution comprises protrusions of the emitter material from the main emitter face which contact the main collector face thermally but not electrically. The main collector ends of the protrusions are separated from the main collector by a thin layer of insulation, such as aluminum oxide. The diode effect will increase with the use of metals that adsorb cesium less readily for the main emitter ends of the tiny protrusions and metals that adsorb cesium more readily for the main collector ends of the protrusions. Author

N81-19562*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SATELLITE POWER STUDY (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). VOLUME 1: EXECUTIVE SUMMARY Final Report
G. M. Hanley Washington NASA Mar. 1981 50 p refs (Contract NAS8-32475)
(NASA-CR-3392; SSD-80-0108-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Efforts concentrated on updating of the Rockwell reference concept, definition of new system options, studies of special emphasis topics, further definition of the transportation system, and further program definition. The Rockwell reference satellite concept has a gallium arsenide (GaAs) solar cell array having flat concentrators with an effective concentration ratio of 1.83 at end of life. Alternatives to this concept includes solid state power amplifiers or magnetrons for dc/RF conversion and multibandgap solar cells for solar to dc energy conversion. Two solid state concepts were studied. It was determined that the magnetron approach was the lowest mass and cost system. T.M.

N81-19563# Aeronautical Research Labs., Melbourne (Australia).
WIND ENERGY - HOW RELIABLE
Douglas J. Sherman Jan. 1980 36 p refs
(AD-A094988; ARL/STRUC-380) Avail: NTIS HC A03/MF A01 CSCL 04/2

The reliability of a wind energy system depends on the size of the propeller and the size of the back-up energy storage. Design of the optimum system for a given reliability level can be performed if a time series of wind speed data is available. However, a design based on conventional meteorological records, which sample the wind speed with a ten minute averaging time at three-hourly intervals, will over-estimate the storage by a factor of approximately 2, and if the wind speed is only available on a daily basis the storage will be over-estimated by a factor of 2.5 to 4.0. This is because a propeller can respond to wind speed changes in much less than ten minutes and also because three-hourly sampling does not often pick up the brief high-speed incidents which generate a significant part of the wind energy. A nomogram is presented, based on some continuous wind speed measurements, which enables storages calculated from three-hourly or daily data to be appropriately reduced because of these two effects. GRA

N81-19564*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS). LSST SYSTEMS AND INTEGRATION TASK FOR SPS FLIGHT TEST ARTICLE Final Report
H. S. Greenberg Washington NASA Feb. 1981 142 p refs (Contract NAS8-32475)
(NASA-CR-3375; SSD-80-0102) Avail: NTIS HC A07/MF A01 CSCL 10A

This research activity emphasizes the systems definition and resulting structural requirements for the primary structure of two potential SPS large space structure test articles. These test articles represent potential steps in the SPS research and technology development. Author

N81-19565*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION

STUDY (EXHIBIT D). VOLUME 3: TRANSPORTATION ANALYSIS Final Report
G. M. Hanley Washington NASA Mar. 1981 85 p refs
(NAS8-32475)
(NASA-CR-3394; SSD-80-0108-3) Avail: NTIS HC A05/MF A01 CSCL 10A

Additional analyses and investigations were conducted to further define transportation system concepts that will be needed for the developmental and operational phases of an SPS program. To accomplish these objectives, transportation systems such as the Shuttle and its derivatives were identified; new heavy lift launch vehicle (HLLV) concepts, cargo and personnel orbital transfer vehicles (EOTV and POTV), and intraorbit transfer vehicle (IOTV) concepts were evaluated; and, to a limited degree, the program implications of their operations and costs were assessed. The results of these analyses were integrated into other elements of the overall SPS concept definition studies. T.M.

N81-19566*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). VOLUME 4: OPERATIONS ANALYSES Final Report
G. M. Hanley Washington NASA Mar. 1981 103 p refs
(Contract NAS8-32475)
(NASA-CR-3395; SSD-80-0108-4) Avail: NTIS HC A06/MF A01 CSCL 10A

Using a coplanar, end-mounted antenna as a baseline, various configuration trades were performed to select a preferred solid state concept. The increase in efficiency that could be realized by use of multi bandgap solar cells, either with klystron or solid state antenna was evaluated. Satellite configurations were developed to exploit the sandwich antenna concept wherein solar cells are located on one side of the antenna panel and solid state dc/RF converters on the other side. These concepts entailed various primary and secondary reflector arrangements for directing solar energy to the solar cell side of the antenna with higher concentration ratios than used on the coplanar configurations. Operations analysis included development of a satellite construction scenario, a concept for the SCB, a top-level satellite construction operation, construction operation, construction timelines and crew sizes, mass flows to orbit, and a satellite maintenance scenario. The list of materials required for satellite construction was updated to identify significant differences relevant to the solid state satellite concept. Means of decommissioning satellites at the end of their design life were studied. A.R.H.

N81-19567*# Hughes Aircraft Co., El Segundo, Calif.
CONCEPTUAL DESIGN STUDY OF CONCENTRATOR ENHANCED SOLAR ARRAYS FOR SPACE APPLICATIONS. PERFORMANCE EVALUATION OF 5 KW AND 20 KW SYSTEMS IN SI AND GaAs AT 1 AU EMPLOYING A FLAT PLATE TROUGH CONCENTRATOR Final Report
20 Oct. 1980 72 p refs
(Contracts NAS7-100; JPL-955194)
(NASA-CR-164038; JPL-9950-463; Hughes-Ref-E3256) Avail: NTIS HC A04/MF A01 CSCL 10A

A simple, efficient and very lightweight preliminary design for a 5 KW and 20 KW BOL output concentrated array evolved and is described by drawings. The relative effectiveness of this design, as compared to an unconcentrated planar array of equal power output, was measured by comparing power to mass performance of and the solar cell area required by each. Improvements in power to mass performance as high as 42% together with array area size reduction of 57% are possible in GaAs systems. By contrast, when the same concentrator design is applied to silicon systems, no improvement in power to mass can be obtained although array area reductions as high as 35% are obtainable. L.F.M.

N81-19568*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
INVESTIGATION OF RELIABILITY ATTRIBUTES AND ACCELERATED STRESS FACTORS ON TERRESTRIAL SOLAR CELLS Annual Report
J. W. Lathrop, R. A. Hartman, and C. R. Saylor Jan. 1981 255 p refs Sponsored in part by DOE Prepared for JPL
(Contract NAS7-100)
(NASA-CR-164012; JPL-9950-481; AR-3;
DOE/JPL-954929-81/8) Avail: NTIS HC A12/MF A01 CSCL 10A

Major effort during this reporting period was devoted to two tasks: improvement of the electrical measurement instrumentation through the design and construction of a microcomputer controlled short interval tester, and better understanding of second quadrant behavior by developing a mathematical model relating cell temperature to electrical characteristics. In addition, some preliminary work is reported on an investigation into color changes observed after stressing. T.M.

N81-19569*# RCA Corp., Princeton, N. J. Solid State Div.
DEVELOPMENT OF MEGASONIC CLEANING FOR SILICON WAFERS Final Report
A. Mayer Sep. 1980 96 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-955342)
(NASA-CR-164011; DOE/JPL-955342-79/2; JPL-9950-498) Avail: NTIS HC A05/MF A01 CSCL 10A

A cleaning and drying system for processing at least 2500 three in. diameter wafers per hour was developed with a reduction in process cost. The system consists of an ammonia hydrogen peroxide bath in which both surfaces of 3/32 in. spaced, ion implanted wafers are cleaned in quartz carriers moved on a belt past two pairs of megasonic transducers. The wafers are dried in the novel room temperature, high velocity air dryer in the same carriers used for annealing. A new laser scanner was used effectively to monitor the cleaning ability on a sampling basis. T.M.

N81-19570*# Lamar Univ., Beaumont, Tex.
PROCESS FEASIBILITY STUDY IN SUPPORT OF SILICON MATERIAL TASK 1 Final Report, 1 Oct. 1975 - 6 Feb. 1981
Carl L. Yaws, Ku-Yen Li, Jack R. Hopper, C. S. Fang, and Keith C. Hansen 6 Feb. 1981 461 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954343)
(NASA-CR-164009) Avail: NTIS HC A20/MF A01 CSCL 10A

Results for process system properties, chemical engineering and economic analyses of the new technologies and processes being developed for the production of lower cost silicon for solar cells are presented. Analyses of process system properties are important for chemical materials involved in the several processes under consideration for semiconductor and solar cell grade silicon production. Major physical, thermodynamic and transport property data are reported for silicon source and processing chemical materials. T.M.

N81-19571*# Acurex Corp., Mountain View, Calif. Alternate Energy Div.
ADVANCED SOLAR CONCENTRATOR MASS PRODUCTION, OPERATION, AND MAINTENANCE COST ASSESSMENT Final Report
W. A. Niemeyer, R. J. Bedard, and D. M. Bell Jan. 1981 101 p refs
(Contracts NAS7-100; JPL-955477)
(NASA-CR-164039; ACUREX-FR-80-14/AE; DRL-015; DRO-SE003) Avail: NTIS HC A06/MF A01 CSCL 10A

The object of this assessment was to estimate the costs of the preliminary design at: production rates of 100 to 1,000,000 concentrators per year; concentrators per aperture diameters of 5, 10, 11, and 15 meters; and various receiver/power conversion package weights. The design of the cellular glass substrate Advanced Solar Concentrator is presented. The concentrator is an 11 meter diameter, two axis tracking, parabolic dish solar concentrator. The reflective surface of this design consists of inner and outer groups of mirror glass/cellular glass gores. T.M.

N81-19572*# Photowatt International, Inc., Tempe, Ariz.
ARRAY AUTOMATED ASSEMBLY TASK LOW COST SILICON SOLAR ARRAY PROJECT, PHASE 2 Final Report
Clayton Olson Dec. 1980 321 p refs Sponsored in part by DOE Prepared for JPL Prepared in cooperation with Sensor

Technology, Inc., Chatsworth, Calif.
(Contract JPL-954865)
(NASA-CR-164037; DOE/JPL-954865-80/9; JPL-9950-509) Avail: NTIS HC A14/MF A01 CSCL 10A

Analyses of solar cell and module process steps for throughput rate, cost effectiveness, and reproductibility are reported. In addition to the concentration on cell and module processing sequences, an investigation was made into the capability of using microwave energy in the diffusion, sintering, and thick film firing steps of cell processing. Although the entire process sequence was integrated, the steps are treated individually with test and experimental data, conclusions, and recommendations. T.M.

N81-19573*# Westinghouse Research and Development Center, Pittsburgh, Pa. Research and Development Center.
CELL MODULE AND FUEL CONDITIONER DEVELOPMENT Quarterly Report, Oct. - Dec. 1980
D. Q. Hoover, Jr. Jan. 1981 72 p refs
(Contracts DEN3-161; DE-AI01-80ET-17088)
(NASA-CR-165190; DOE/NASA/0161-6; Rept-80-9E6-MARED-R5; QR-5) Avail: NTIS HC A04/MF A01 CSCL 10A

The test results of and post test analysis of Stack 559 are reported. The design features and construction status of Stacks 560, 561, 562 and 563 are described. The measurements of cell materials compressibility are rationalized and summarized and an explanation of their uses is given. Preliminary results of a manifold material/coating survey are given. The results of shift converter catalyst performance tests and reforming catalyst aging tests are reported. State points for full load and part load operation of the fuel conditioning subsystem tabulated. Work on the data base for the fuel conditioner ancillary subsystems is summarized. T.M.

N81-19574 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.
TECHNICAL EVALUATION OF GASEOUS SUSPENSIONS OF GRAPHITE FOR THE ABSORPTION OF CONCENTRATED SOLAR RADIATION
Mohamed A. M. Abdelrahman 1979 174 p refs Sponsored in cooperation with Federal Institute of Technology, Luasanne, and Sudan National Council for Research
(EPFL-ITA-6; ISBN-3-2600-4592-9) Avail: Issuing Activity

The direct absorption of concentrated solar radiation by a gaseous suspension of graphite was investigated. The problem of agglomeration and deposition as well as the particle size distribution as a function of time were studied theoretically and experimentally. Suspended particles of about the incident radiation wavelength size were shown to absorb adequately in a technically reasonable suspension thickness and have, in addition, selective properties (low emittance in the infrared). Agglomeration and deposition properties were shown to change if the particles are coated with a silicone base layer. Author (ESA)

N81-19575# Naval Research Lab., Washington, D. C.
PULSED HIGH VOLTAGE AND HIGH CURRENT OUTPUTS FROM HOMOPOLAR ENERGY STORAGE SYSTEM Interim Report
R. D. Ford, D. Jenkins, W. H. Lupton, and J. M. Vitkovitsky 4 Feb. 1981 16 p refs
(RR0110941)
(AD-A094910; NRL-MR-4433) Avail: NTIS HC A02/MF A01 CSCL 10/2

Large energy storage capability of inertial inductive systems provides an attractive option for satisfying the pulse power requirements associated with such applications as plasma confinement and heating, electromagnetic projectile acceleration and with production of intense radiation. These applications require high rate of energy delivery to the load at specific current and voltage levels. In conjunction with self-excited homopolar generator current source, an opening technology has been developed to provide up to 1 MJ output pulses, alternately, at hundreds of kilovolts or at megampere levels. The overall system efficiency, which depends sensitively on the load requirements, was measured over a range from 10% to more than 90% for different pulser load circuit arrangements. GRA

N81-19576# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
THE US AIR FORCE ACADEMY SOLAR ENERGY RESEARCH PROJECT SUMMARY REPORT Progress Report, Apr. 1975 - Jan. 1980
Kenneth A. Cornelius Jul. 1980 103 p refs
(AF Proj. 2054)
(AD-A094802; AFESC/ESL-TR-80-35) Avail: NTIS HC A06/MF A01 CSCL 13/1

This report summarizes the solar energy research which was conducted by the U.S. Air Force Academy from April 1975 to January 1980. This research consisted of investigations on a retrofit space heating system which was installed on a typical Military Family Housing (MFH) unit. This summary uses a lessons learned and designer tips approach in its discussion of the solar system's operation. This discussion is organized around the many areas of solar technology which were investigated during the course of this project. Those major areas were energy conservation effects, solar collectors, thermal storage, control systems, Thermography studies, performance comparison to a design model, and homeowner and maintenance manual development. A thermal performance summary of the solar system is also presented. The report concludes with numerous recommendations regarding policy initiatives which the Air Force should take to foster conversion to solar technology. GRA

N81-19577# Altus Corp., San Jose, Calif.
PRIMARY LITHIUM-THIONYL CHLORIDE CELL EVALUATION Final Report, Sep. 1979 - Apr. 1980
A. E. Zolla, R. Waterhouse, D. DeBiccari, and G. L. Griffin Aug. 1980 93 p
(Contract F33615-79-C-2072; AF Proj. 3145)
(AD-A094660; AFWAL-TR-80-2076) Avail: NTIS HC A05/MF A01 CSCL 10/3

A test program was conducted to evaluate the Altus 1350AH cell performance against the Minuteman Survival Ground Power requirements. Twelve cells of the 17 inch diameter, 1-3/8 inch heights were fabricated and tested during this study. Under discharge rates varying from C/100 to C/400 at ambient temperature, the volumetric and gravimetric energy density performance requirements of 15 watt hours per cubic inch and 150 watt hours per pound were exceeded in all cases. All other performance requirements of voltage, current, configuration, capacity volume, weight, electrolyte leakage (none), and maintainability (none required), were met or exceeded. The abuse testing demonstrated the Altus Cell's ability to safely withstand short circuit by external shorting, short circuit by penetration with a conductive object, forced discharge, and forced charging of a cell. Disposal of discharged cells by incineration is an environmentally safe and efficient method of disposal. GRA

N81-19578# Martin Marietta Aerospace, Denver, Colo.
TERRESTRIAL PHOTOVOLTAIC SYSTEM ANALYSIS Final Report, Feb. - Nov. 1979
Matthew S. Imamura, Roger Giellis, and Robert L. Moser Wright-Patterson AFB, Ohio AFWAL Jul. 1980 117 p refs (Contract F33615-79-C-2001; AF Proj. 3145)
(AD-A094827; MCR-80-683; AFWAL-TR-80-2074) Avail: NTIS HC A06/MF A01 CSCL 10/1

The purpose of this program was to evaluate the use of an actively cooled photovoltaic power system at Tinker Air Force Base, Oklahoma, which required both electrical and thermal energy. The thrust of the study was to identify a preliminary design of an actively cooled photovoltaic concentrator configuration including the necessary details of integrating it into the facility, and compare the cost of this system and that of the present energy sources. A conventional utility-connected arrangement was selected for the Tinker AFB electroplating facility mainly because of simplicity in its implementation and availability of the inverter, which is the key component in the system. The system uses a direct energy transfer arrangement with a peak array power tracking inverter; no electrochemical storage batteries are used. The thermal energy distribution system interfaces directly with the plating tanks in the facility. The estimated initial installed cost of the combined photovoltaic/thermal system is $28 per watt. The use of thermal energy for the plating tanks is costly ($3 per watt) because of an extensive distribution system and use of exotic heat exchangers. GRA

N81-19579# United Technologies Corp., South Windsor, Conn. Power Systems Div.
OPTIMIZATION OF CARBON-SUPPORTED PLATINUM CATALYSTS FOR FUEL CELL ELECTRODES Final Technical Report, Oct. 1979 - Oct. 1980
H. R. Kunz, F. J. Luczak, and G. A. Gruver Dec. 1980 51 p (Contract DAAK70-79-C-0151; DA Proj. 1L1-62733-AH-20) (AD-A094714; PSD/UTC-FCR-2834) Avail: NTIS HC A04/MF A01 CSCL 09/1

The objective of this program was to optimize electrodes using the carbon supported platinum catalysts at the operating conditions required for use in methanol air, phosphoric acid electrolyte, fuel cell power plants for U.S. Army applications. Cathodes using proprietary, supported platinum catalyst, GSA-6, were fabricated with various degrees of hydrophobicity by adjusting the Teflon content in the catalyst layer and by changing the Teflon sintering cycle. These cathodes were tested with supported platinum anodes in eighteen subscale cells at the Army power plant operating conditions for periods exceeding 5000 hours. The optimum structure, on the basis of peak cell voltage, endurance stability, and manufacturing reproducibility was found to be one containing 47.5% Teflon. A standard United proprietary anode catalyst showed satisfactory peak performance and endurance stability. The cells with optimized electrodes exceeded the program 500 hour performance goal of 0.620V at 200 mA/cubic centimeters by 0.020V. The 6000 hour performance goal of 0.590 V at 200 mA/cubic centimeters was projected to be exceeded by 0.036 to 0.038 V (based on over 4000 hours of operation. GRA

N81-19580# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPUTER SIMULATION OF SOLAR AIR HEATING SYSTEMS USING ROCK BED THERMAL STORAGE UNITS M.S. Thesis
Daniel Bartholomew Fant Dec. 1980 144 p refs (AD-A094771; AFIT/GAE/AA/80D-4) Avail: NTIS HC A07/MF A01 CSCL 09/2

This thesis is concerned with the analysis and design of solar air heating systems utilizing rock beds as thermal storage units. A computer simulation model capable of estimating the response of both the solar collector and the rock bed is described. Differential equations describing the rock bed were approximated in a finite-difference form and solved numerically on a digital computer. The temperature of both the solid (rock) and the fluid (air) is determined as a function of time and distance along the bed. The simulation required both charging and discharging of the rock bed for time-varying inlet fluid temperatures. The numerical method used to solve the rock bed equations proved to be stable and convergent and showed satisfactory agreement in comparison to an analytical solution for constant-inlet air temperature. A cost analysis was also incorporated within this program; by varying the collector area one could determine the optimum collector size for maximum savings. Pressure drop relationships for flat-plate collectors, duct work and packed beds were used to determine operating costs. The particular air system tested proved to be cost effective when compared with natural gas fuel costs for an economic term of 20 years. GRA

N81-19581# Grumman Energy Systems, Inc., Bohemia, N.Y.
DEVELOPMENT OF AN 8 KILOWATT WIND TURBINE GENERATOR FOR RESIDENTIAL TYPE APPLICATIONS. PHASE 1: DESIGN AND ANALYSIS. VOLUME 2: TECHNICAL REPORT
F. M. Adler, L. G. Angeloff, P. Henton, and P. W. King Mar. 1980 92 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3007-Vol-2) Avail: NTIS HC A05/MF A01

The Windstream 25 (WS-25) WTG showed a good match with the requirements for the 8kW WTG. The configuration overview, cost analysis, and design criteria are presented. The parametric and trade off studies, as well as supporting analysis are included. It was concluded that the WTG fell short of the original statement in only one area, that of achieving the target capital cost goal of $750/kW (1977 dollars). E.D.K.

N81-19582# Institute of Gas Technology, Chicago, Ill.
ELECTROCHEMICAL PHOTOVOLTAIC CELLS Final Technical Progress Report, 15 Apr. 1979 - 17 Apr. 1980
Peter G. P. Ang and Anthony F. Sammells Sep. 1980 103 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract EC-77-C-01-4042)
(SERI/TR-8002-5-T1) Avail: NTIS HC A06/MF A01

Increasing solar energy conversion efficiencies and identifying potentially long-life systems were emphasized. Semiconductor/redox couple systems were selected on the basis of the apparent positions of their conduction and valence band energy levels at the interface, together with the semiconductor decomposition potential. Selected redox couples should possess equilibrium potentials that lie negative of the semiconductor decomposition potential and positive of the semiconductor conduction band. Liquid-junction solar cells were characterized using n-MoSe2, N-MoS2, n-WSe2, n-CdSe, and n-GaAs as photo-anodes. T.M.

N81-19583# Catalytica Associates, Inc., Santa Clara, Calif.
DISTILLATE FUEL-OIL PROCESSING FOR PHOSPHORIC ACID FUEL CELL POWER PLANTS
Feb. 1980 141 p refs
(Contract DE-AC03-77ET-13323)
(DOE/ET-13323/2) Avail: NTIS HC A07/MF A01

Efforts to develop distillate oil steam reforming processes are reviewed, and the applicability of these processes for integration with the fuel cell are discussed. The development efforts can be grouped into the following processing approaches: high temperature steam reforming; autothermal reforming; autothermal gasification; and ultra desulfurization followed by steam reforming. Sulfur in the feed is a problem in the process development. DOE

N81-19584# Harbridge House, Inc., Washington, D.C. Office of Environmental Assessments.
GROUND WATER AND ENERGY: PROCEEDINGS OF THE US DEPARTMENT OF ENERGY'S NATIONAL WORKSHOP
Nov. 1980 213 p refs Workshop held in Albuquerque, N. Mex., 29-31 Jan. 1980
(Contract W-7405-eng-36)
(CONF-800137) Avail: NTIS HC A10/MF A01

This national workshop on ground water and energy was conceived by the US Department of Energy's Office of Environmental Assessments. Generally, OEA needed to know what data are available on ground water, what information is still needed, and how DOE can best utilize what has already been learned. The workshop focussed on three areas: (1) ground water supply; (2) conflicts and barriers to ground water use; and (3) alternatives or solutions to the various issues relating to ground water. DOE

N81-19585# Zaininger Engineering Co., San Jose, Calif.
WIND POWER GENERATION DYNAMIC IMPACTS ON ELECTRIC UTILITY SYSTEMS Final Report
H. W. Zaininger Nov. 1980 88 p refs Sponsored by Electric Power Research Inst.
(EPRI-AP-1614) Avail: NTIS HC A05/MF A01

A primary application of windpower generation on utility systems is expected to be large clusters of megawatt scale wind turbine (WT) units connected to the utility transmission network and operated as part of the overall utility generation mix. Wind fluctuations will result in minute to minute WT output variations. Large penetrations of wind turbines may cause dynamic impacts such as severe system swings, excessive frequency excursions, or system instability. These potential dynamic impacts, considering the integrated wind power plants, utility conventional generation, and transmission system, may limit the potential WT penetration and/or cause significant system operating restrictions. An initial assessment of potential wind power generation dynamic impacts on utility systems from a global utility perspective was made. Dynamic study of minute to minute ramping, frequency excursion, and short term transient stability was performed. DOE

N81-19586# Public Service Co. of Indiana, Plainfield.
COMPRESSED AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. TASK 1: ESTABLISH FACILITY DESIGN CRITERIA AND UTILITY BENEFITS
Oct. 1980 390 p Sponsored in part by EPRI
(Contracts DE-AC02-78ET-29232; ET-76-C-01-2159)
(DOE/ET-29232/T2) Avail: NTIS HC A17/MF A01

Compressed air energy storage (CAES) stores mechanical energy in the form of compressed air during off-peak hours, using power supplied by a large, high efficiency baseload power plant. At times of high electrical demand, the compressed air is drawn from storage and is heated in a combustor by the burning of fuel oil, after which the air is expanded in a turbine. Essentially all of the turbine output can be applied to the generation of electricity, unlike a conventional gas turbine which expends approximately two-thirds of the turbine shaft power in driving the air compressor. The separation of the compression and generation modes in the system results in increased net generation and greater premium fuel economy. Work performed in establishing facility design criteria for a CAES system with aquifer storage includes: determination of initial design bases; preliminary analysis of the CAES system; development of data for site-specific analysis of the CAES system; detailed analysis of the CAES system for three selected heat cycles; CAES power plant design; and an economic analysis of CAES. DOE

N81-19587# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

CSU SOLAR HOUSE 3 SOLAR HEATING AND COOLING SYSTEM PERFORMANCE Annual Technical Summary Report, 1 Oct. 1978 - 30 1979

D. S. Ward, John C. Ward, and H. S. Beroi Oct. 1980 85 p refs

(Contract DE-AC02-79CS-30122)

(DOE/CS-30122/T1) Avail: NTIS HC A05/MF A01

The practicality of an integrated flat plate state-of-the-art liquid-heating solar collector and absorption cooling system is studied. This was accomplished by designing and installing a complete solar heating and cooling system (including appropriate data acquisition equipment and instrumentation), performing a detailed analysis and evaluation of all aspects of the solar system, and comparing the seasonal performance of the system with two other solar heating and cooling systems installed in adjacent buildings with virtually identical thermal characteristics. DOE

N81-19588# Oak Ridge National Lab., Tenn. Fossil Energy Program.

FOSSIL ENERGY PROGRAM Quarterly Progress Report, period ending 30 Sep. 1980

L. E. McNeese Jan. 1981 348 p refs

(Contract W-7405-eng-26)

(ORNL-5702) Avail: NTIS HC A15/MF A01

Progress is reported for the period July 1 through September 30 for the Oak Ridge National Laboratory research and development projects that are carried out in support of the increased utilization of coal and other fossil fuels as sources of clean energy. These projects are supported by various parts of DOE including Fossil Energy, Basic Energy Sciences, Office of Health and Environmental Research, Office of Environmental Compliance and Overview, Economic Regulatory Administration, Power Research Institute, and by the Tennessee Valley Authority and the EPA Office of Research and Development through interagency agreements DOE

N81-19589# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

DEVELOPMENT OF A PROTOTYPE HEAT ENGINE FOR ENERGY CONSERVATION Progress Report, Oct. - Dec. 1979

W. S. Ginell Jan. 1980 9 p

(Contracts DE-AC05-78OR-06028; ET-78-C-05-6028)

(DOE/OR-06028/T6) Avail: NTIS HC A02/MF A01

The goals of this program are to produce a 1 hp Nitinol heat engine; to obtain a set of performance measurements over a range of operating conditions, and to establish design relations between performance and hardware configurature, engine dimensions, and Nitinol characteristics. The principal efforts were directed toward completion and initial operation of the Nitinol Engine Module (MOD). Diagnostic instrumentation was completed and a computerized data acquisition system was installed. Nitinol elements for MOD were conditioned and installed and the MOD was operated briefly. The first samples of Nitinol manufactured and processed at ORNL (Type 3) were characterized, and a second sample (Type 5) was received. DOE

N81-19590# Computer Sciences Corp., Vienna, Va.

REVIEW OF ACTIVITIES AND PLANS FOR SOLAR ENERGY IN FEDERAL BUILDINGS

Oct. 1980 35 p refs

(Contract DE-AC01-79CR-10001)

(DOE/CR-10001/T2) Avail: NTIS HC A03/MF A01

Federal Buildings Program and plans regarding the use of solar energy are reported. Recommendations concerning the solar Federal Buildings Program's plan are given, specifically an analysis of agencies' Ten Year Buildings construction, leasing and retrofit plans to provide visibility for and detailed knowledge of Federal agencies planning regarding solar and other renewable resources. Statistical information regarding planned solar projects, and recommendations concerning the SFBP plans are presented. DOE

N81-19591# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.

HELIOSTAT MATERIALS DEVELOPMENT AND EVALUATION Final Technical Report, 5 Feb. 1979 - 30 Jun. 1980

1980 110 p

(Contract DE-AC04-76DP-00789)

(SAND-78-8193) Avail: NTIS HC A06/MF A01

Both UV stabilized poly (ethylene terephthalate) (PET) polyvinylidiene fluoride films were produced, characterized, and tested to establish a data base of predicting life cycles and upgrading the cost/performance ratio of heliostat enclosures. Laminated aluminized PET, protected and unprotected by a thin layer of resin was studied as suitable reflector material. Procedures and results of weathering tests are presented. Methods for bonding plastic films, specularly optimized film reflectors, and the mechanism of a weathering degradation are discussed. Data on the flammability of plastic films are included. DOE

N81-19592# General Electric Co., Schenectady, N. Y. Dept. of Corporate Research and Development.

LAMINATED COMPOSITE DISC FLYWHEEL DEVELOPMENT Interim Report, 1 Jul. 1979 - 10 Jan. 1980

R. P. Nimmer, K. Torossian, and J. Hickey Feb. 1980 94 p refs

(Contract W-7405-eng-48)

(UCRL-15301; IR-3) Avail: NTIS HC A05/MF A01

A flywheel concept for an electric powered vehicle uses a laminated disc and a filament wound outer ring assembled with an interference fit between these two components. The laminated, central disc is made of S2-glass-epoxy and the outer ring is filament-wound graphite-epoxy. Projections for this particular flywheel design indicate that it will be both practical and relatively inexpensive to produce, and that it will have a high energy density capacity. Two hybrid composite flywheels of 37 cm O.D. were successfully assembled. The spin test data are summarized, the nondestructive test dat are discussed and the fabrication techniques developed for the hybrid flywheel assembly are described. DOE

N81-19593# General Electric Co., Philadelphia, Pa. Space Center.

DEVELOPMENT AND DEMONSTRATION OF A STIRLING/RANKINE HEAT ACTIVATED HEAT PUMP Semiannual Report, Jan. - Jun. 1980

1980 108 p

(Contract DE-AC02-77CS-20043)

(COO-2911-7) Avail: NTIS HC A06/MF A01

Progress on development of the gas heat pump is reported. Concentrated effort on the integrated testing of the combustor/engine/compressor assembly in the integrated test stand is described. Data from the integrated test were reduced and analyzed and performance improvement modifications were made and tested. Additional component tests were performed on the compressor, air handler units, and combustor in parallel with integrated testing. Development work continued on the alternate engine starter design options, seal and bearing life, and transient load acceptance. Major system development accomplishments on the combustor, engine, compressor, controls, and air handlers are described in detail. Detailed descriptions of the program progress on each subsystem, overall product design, and all other related program areas are presented. DOE

N81-19594# General Electric Co., Philadelphia, Pa. Space Systems Operations.
DEVELOPMENT OF A PHOTOVOLTAIC CONCENTRATOR CELL ASSEMBLY FOR USE IN POINT FOCUS SYSTEMS Final Report
Dec. 1980 60 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7139) Avail: NTIS HC A04/MF A01

A solar cell mount assembly for use in a Fresnel lens point focus concentrator system was developed. A direct bonded copper on alumina insulator provides the required electrical isolation with a thermal resistance of less than 0.2(0) C/watt between the solar cell junction and the interface of the mount with the module baseplate. High lead solder, Indalloy 151, is used to attach the cell contacts to the direct bonded copper conductors and to attach the insulator subassembly to a copper heat spreader which provides the centrally located mounting stud for the assembly. This solder composition demonstrated superior fatigue resistance, when compared to 60 percent tin solder, when subjected to thermal cycling in a bimetal sandwich laminate. Development cell mounts of this design were subjected to a thermal cycling test exposure, consisting of 100 cycles between the extremes of -30 and +50(0) C followed by 100 cycles between the extremes of +50 to +150(0) C, without measurable changes in the thermal resistance. DOE

N81-19595# General Electric Co., Philadelphia, Pa. Space Systems Operations.
DEVELOPMENT OF A COMBINED PHOTOVOLTAIC/THERMAL LINEAR RECEIVER FOR A PARABOLIC TROUGH CONCENTRATOR Final Report
Dec. 1980 61 p
(Contract DE-AC04-76DP-00789)
(SAND-80-7138) Avail: NTIS HC A04/MF A01

The development of a receiver design for a linear focus concentrator is discussed. The design concept described employs a pair of nested glass tubes. A specially configured inner borosilicate glass tube functions as the mounting surface for the solar cell circuit in this dual focus receiver geometry. This inner tube, which is capped at each end to provide an interior dead air space, is inserted within a 2 inch ID glass pipe which is part of Corning Pyrex beaded pressure process piping system. The selected receiver coolant, which is designated as Synfluid (2 centistokes kineamatic viscosity), is circulated through the outer glass pipe in direct contact with the solar cell circuit active area. The concentrated irradiance from the parabolic trough impinges on the outer glass pipe and is optically transmitted through the clear synthetic mineral oil to the solar cell circuit. Two prototype receivers of this design were fabricated and assembled. DOE

N81-19596# Los Alamos Scientific Lab., N. Mex.
SOME LONG-TERM ENERGY OPTIONS
J. R. Bartlit and F. J. Edeskuty Dec. 1980 8 p refs
(Contract W-7405-eng-36)
(LA-8628-MS) Avail: NTIS HC A02/MF A01

Some energy options, although of little immediate use, still offer advantages which make them worthy of continued investigation to determine their feasibility and their potential. These technologies include the possibility of recovering vast amounts of methane from naturally occurring methane hydrates and the use of hydrogen as a fuel. The inherently high risk of these technologies for short term payoff makes them a particularly appropriate concern for national laboratories. DOE

N81-19597# Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
ALASKA: A GUIDE TO GEOTHERMAL ENERGY DEVELOPMENT
N. Basescu, R. Gordon Bloomquist, Charles Higbee, Debra Justus, and Stuart Simpson Jun. 1980 117 p refs Prepared in cooperation with Alaska State Div. of Energy and Power Development
(Contract DE-AS06-77ET-28476)
(DOE/ET-28476/T12) Avail: NTIS HC A06/MF A01

Alaska's geothermal potential, exploration, drilling, utilization, and legal and institutional setting are covered. Economic factors of direct use projects are discussed. DOE

N81-19598# Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
OREGON: A GUIDE TO GEOTHERMAL ENERGY DEVELOPMENT
Debra Justus, Neil Basescu, R. Gordon Bloomquist, Charles Higbee, and Stuart Simpson Jun. 1980 121 p refs
(Contract DE-AS06-77ET-28476)
(DOE/ET-28476/T11) Avail: NTIS HC A06/MF A01

Oregon's geothermal potential exploration, drilling, utilization, legal and institutional setting are covered. Economic factors of direct use projects are discussed. DOE

N81-19599# Oak Ridge National Lab., Tenn. Energy Div.
DESIGN OPTIMIZATION OF CONVENTIONAL HEAT PUMPS: APPLICATION TO STEADY STATE HEATING EFFICIENCY
C. K. Rice, S. K. Fischer, R. D. Ellison, and W. L. Jackson 1981 28 p refs Presented at the ASHRAE Meeting, Chicago, 25 Jan. 1981
(Contract W-7405-eng-26)
(CONF-810101-5) Avail: NTIS HC A03/MF A01

A physically based heat pump model was connected to an optimization program to form a computer code for use in the design of high efficiency heat pumps. The method used allows for the simultaneous optimization of selected design variables, taking proper account of their interactions, while constraining other parameters to chosen limits or fixed values. For optimization of the steady state heating efficiency of conventional heat pumps, ten variables were optimized while heating capacity was fixed; the results may, however, be scaled to other capacities. Calculations were made for a range of component efficiencies and heat exchanger sizes. The results predict substantial improvement in heating performance due to both optimal system configuration and the use of improved components. Sensitivity analyses show that there is considerable latitude for deviating from the optimum design to make use of available component sizes and for accomodating the compromises needed for good cooling performance. DOE

N81-19600# Rockwell International Corp., Golden, Colo. Rocky Flats Wind System Program.
SMALL WIND SYSTEMS TECHNOLOGY ASSESSMENT, STATE OF THE ART AND NEAR TERM GOALS
W. S. Bollmeier, C. P. Butterfield, R. P. Cingo, A. C. Hansen, D. C. Shepherd, and J. L. Tangler Feb. 1980 84 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3136/3533/80/18) Avail: NTIS HC A05/MF A01

Commercially available small wind conversion systems (SWECS), DOE funded prototype SWECS, and possible second generation advanced concepts are assessed from the standpoint of several key Figures-of-Merit including cost of energy, dollars per pound, kilowatt hours per year per pound, and kilowatt hours per year per square meter of rotor area. The reliability, performance, and installation and maintenance costs of these systems are also assessed. It is concluded that current SWECS, while nearing the threshold of competitiveness with conventional energy sources, are inhibited from reaching their lowest cost potential by the use of off-the-shelf components, less than optimum rotor designs, and (in some cases) overly complicated control systems. The comparisons of improved DOE prototypes and possible advanced concept SWECS shows that, in many size ranges, considerable reductions in energy cost can be achieved. DOE

N81-19601# Rockwell International Corp., Golden, Colo.
DUNLITE MODEL 81/002550 WIND TURBINE GENERATOR Final Test Report
K. K. Higashi Feb. 1980 24 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3149/3533/80-17) Avail: NTIS HC A02/MF A01

The Dunlite Model 81/002550 Wind Turbine Generator has met all manufacturer claims of performance and reliability. The machine operated satisfactorily in wind up to the manufacturer rated survival speed of 36 m/s (80 mph). In addition, the Dunlite operated in winds exceeding 22.5 m/s (50 mph) for eight hours without incurring damage. Major damage to the machine occurred when wind speeds exceeded 40.3 m/s (90 mph). If winds of this velocity are expected, the manufacturer offers a high speed model of this wind turbine designed to withstand winds of

49.5 m/s (110 mph). Testing of the Dunlite designed to withstand winds of 49.5 m/s (110 mph). Testing of the Dunlight indicated that the machine is capable of producing its rated output of 2 kw at 11 m/s (25 mpj). DOE

N81-19602# Rice Univ., Houston, Tex.
SATELLITE POWER SYSTEM (SPS). RECTENNA SITING: AVAILABILITY AND DISTRIBUTION OF NOMINALLY ELIGIBLE SITES
Nov. 1980 283 p refs
(Contract DE-AC01-79ER-10041)
(DOE/ER-10041/T10) Avail: NTIS HC A13/MF A01

Siting of 60 ground receiving stations (rectennas) for the SPS may pose a problem due to the large area per rectenna (15,000 hectares, 38,000 acres) and numerous siting constraints. This study analyzes areas potentially eligible for rectenna sites by mapping, at a national scale, those conditions which would preclude rectenna construction. These exclusion variables which reflect restricted lands, topography, safety, national policy and electromagnetic (microwave) effects, were computer encoded and tabulated. Subsequent analysis of the nine electric power planning regions that make up the contiguous states indicate an apparently adequate number of nominally eligible sites in all regions in comparison to projected electrical generation. DOE

N81-19603# Rice Univ., Houston, Tex. Dept. of Sociology.
SOCIAL ACCEPTABILITY OF SATELLITE POWER SYSTEMS (SPS). THE NEAR TERM OUTLOOK
S. L. Klineberg May 1980 61 p refs
(Contract DE-AS05-79ER-10072)
(DOE/ER-10072/1) Avail: NTIS HC A04/MF A01

Current public attitudes make it appear unlikely that a consensus will evolve during the 1980s favoring costly efforts to develop vast new supplies of conventional energy. Opinion polls reveal a pervasive worry over inflation, a broadening of aspirations to encompass quality of life concerns, a growing distrust of central governments, large corporations, big science and technology, and a continuing commitment to environmental protection - all of which suggests a social environment that is likely to resist the development of a major new high technology energy system such as the SPS. DOE

N81-19604# California Univ., Livermore. Lawrence Livermore Lab.
CHARACTERISTICS OF ACIDIC ELECTROLYTE HYDROGEN-AIR FUEL BATTERIES (3)
H. Tajima, M. Sakurai, K. Mizukami, and R. Endo Dec. 1980 11 p refs Transl. into ENGLISH from a Japanese source
(Contract W-7405-eng-48)
(UCRL-Trans-11655) Avail: NTIS HC A02/MF A01

The electrode characteristics of hydrogen air fuel batteries using phosphoric acid as the electrolyte using hydrogen reformed from natural gas were studied. The effects of the impurities, particularly CO, contained in the gas were examined. The effects of the carrier on poisoning of platinum by CO were studied using porous hydrogen electrodes in which carbon was used as the carrier and platform as the catalyst. Also, the effects of the carrier on poisoning in cases where the catalyst used was a compound catalyst consisting of platinum and ruthenium, an oxidation catalyst of CO, are reported. Results are presented and discussed. DOE

N81-19605# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR GASIFICATION OF CARBONACEOUS MATERIALS
R. W. Taylor, R. Berjoan (CNRS, Odeillo, France), and J. P. Coutures (CNRS, Odeillo, France) Apr. 1980 39 p refs
(Contract W-7405-eng-48)
(UCRL-53063) Avail: NTIS HC A03/MF A01

Charcoal, wood, and paper were gasified in a packed bed reactor using steam and solar energy. The steam was generated by spraying water directly onto the surface of the fuel and, at the same time, heating the fuel at the focus of a solar furnace. The steam was generated by solar energy. Half of the steam reacted with carbon, and 30% of the incident solar energy was stored as chemical energy. The performance of a fluidized bed reactor was compared to that of a packed bed reactor using charcoal and CO2. The fraction of the incident solar energy utilized to produce CO (stored) was 10% in the case of the fluidized bed reactor and 40% for the packed bed reactor. DOE

N81-19606# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
AQUIFER THERMAL ENERGY STORAGE: A SURVEY
Chin Fu Tsang, Deborah Hopkins, and Goeran Hellstroem Jan. 1980 49 p refs
(Contract W-7405-eng-48)
(LBL-10441) Avail: NTIS HC A03/MF A01

The technical, economic, and environmental aspects of aquifers storage were investigated. The state of the art of various projects associated with aquifer storage technology were surveyed with emphasis on three broad categories: field experiments; feasibility studies; and theoretical and modeling studies. R.C.T.

N81-19607# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PASSIVE SOLAR ENERGY INFORMATION USER STUDY
W. W. Belew, B. L. Wood, T. L. Marle, and C. L. Reinhardt Nov. 1980 278 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-751-746) Avail: NTIS HC A13/MF A01

The results of a series of telephone interviews with groups of users of information on passive solar heating and cooling are described. These results, part of a larger study on many different solar technologies, identify types of information each group needed and the best ways to get information to each group. The overall study provides baseline data about information needs in the solar community. DOE

N81-19608# National Association of Home Builders (NAHB) Research Foundation, Inc., Rockville, Md.
APPLIANCE ENERGY EFFICIENCY IN NEW HOME CONSTRUCTION Final Report
30 Nov. 1980 31 p
(Contract DE-AC01-80CS-23999)
(DOE/CS-23999/T1) Avail: NTIS HC A03/MF A01

A survey of 224 builders was conducted to which 160 builders responded. Each respondent completed between one and seven separate questionnaires. Each of the seven questionnaires were designed to collect information about one type of equipment or major appliance. These are: heat pump; heating system; air conditioner; domestic water heater; dishwasher; range; and refrigerator. Analyses of the resulting 406 questionnaires indicated that builders were primarily responsible for brand selection. These choices were made primarily without regard for the secondary efficiency of the product. A similar apparent lack of consideration of energy efficiency during brand and model selection was found among home buyers and specialized subcontractors. DOE

N81-19609# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SOLAR/PERFORMANCE GOALS FOR SOLAR AND GROUND-COUPLED HEAT PUMP SYSTEMS
John W. Andrews Sep. 1980 31 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51259) Avail: NTIS HC A03/MF A01

Cost goals for combined solar/heat pump systems are developed. Three methods of analysis are used: simple payback, positive cash flow, and life cycle costing. The goals are parameterized on system energy efficiency, with the air-to-air heat pump as the conventional system which is used as a basis for comparison. Cost goals for nine systems are determined in three generic climates. DOE

N81-19610*# Battelle Columbus Labs., Ohio.
SATELLITE POWER SYSTEMS (SPS) SPACE TRANSPORTATION COST ANALYSIS AND EVALUATION
Nov. 1980 141 p refs Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-164020; DOE/ER-0086) Avail: NTIS HC A07/MF A01 CSCL 22B

A picture of Space Power Systems space transportation costs at the present time is given with respect to accuracy as stated, reasonableness of the methods used, assumptions made, and uncertainty associated with the estimates. The approach used consists of examining space transportation costs from several

perspectives to perform a variety of sensitivity analyses or reviews and examine the findings in terms of internal consistency and external comparison with analogous systems. These approaches are summarized as a theoretical and historical review including a review of stated and unstated assumptions used to derive the costs, and a performance or technical review. These reviews cover the overall transportation program as well as the individual vehicles proposed. The review of overall cost assumptions is the principal means used for estimating the cost uncertainty derived. The cost estimates used as the best current estimate are included. DOE

N81-19611# Argonne National Lab., Ill. Energy and Environmental Systems Div.

EMPLOYMENT IMPACTS OF SELECTED SOLAR AND CONVENTIONAL ENERGY SYSTEMS: A FRAMEWORK FOR COMPARISONS AND PRELIMINARY FINDINGS

Kenneth K. Smeltzer Jan. 1980 37 p refs

(Contract W-31-109-eng-38)

(ANL/EES-TM-116) Avail: NTIS HC A02/MF A01

Preliminary comprehensive analyses of quantitative and qualitative employment effects of selected solar and conventional energy systems are presented. A framework is proposed for analyzing the direct, indirect, induced, displacement, disposable income, and qualitative employment effects of alternative energy systems. The analyses examine current research findings on these effects for a variety of solar and conventional energy sources and compare expected employment impacts. In general, solar energy systems have higher direct and indirect employment requirements than do conventional energy systems. In addition, employment displaced from conventional sources and employment effects due to changes in consumers' disposable income are highly significant variables in net employment comparisons. Analyses of the size and location of projected energy developments suggest that dispersed solar energy systems have a more beneficial impact on host communities than do large conventional facilities, regardless of the relative magnitude of employment per unit of energy output. DOE

N81-19612# Sandia Labs., Livermore, Calif.

FATIGUE-CREEP LIFETIME ANALYSIS OF FOUR ADVANCED CENTRAL RECEIVER CONCEPTS

J. Jones Jan. 1981 20 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-8047) Avail: NTIS HC A02/MF A01

Four advanced central receiver concepts were analyzed for their fatigue-creep design lifetimes. Using the flux profiles provided by the designers, the thermal hydraulic performance of an individual tube in a receiver panel was ascertained by computer analysis. A linear model of the tube crown strain for the tube on given thermal and structural finite element analyses were performed. The computed stresses and strains were used in evaluation of the creep and fatigue design lifetimes by N-47 and compared to the desired lifetime of 30 years. Three of the four designs met or exceeded the desired lifetime and the fourth met the desired lifetime when the factor of safety incorporated in N-47 was reduced. All four designs were judged adequate for the current level of design effort. DOE

N81-19613# Sandia Labs., Albuquerque, N. Mex. Component and Subsystem Development Div.

DEVELOPMENT OF SHEET MOLDING COMPOUND SOLAR COLLECTORS WITH MOLDED-IN SILVERED GLASS REFLECTIVE SURFACES

Roscoe L. Champion and Ronald E. Allred Dec. 1980 41 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-0702) Avail: NTIS HC A03/MF A01

Parabolic test moldings were fabricated from a general purpose sheet molding compound with flat chemically strengthened glass, flat annealed glass, and thermally formed glass. Attempts to mold with annealed sheet glass (1 mm thick) and thermally formed glass (1.25 mm thick) were unsuccessful; only the chemically strengthened glass (1.25 mm thick) was strong enough to survive molding pressures. Because of the mismatch in thermal expansion between glass and sheet molding compound, the as-molded panels contained a sizeable residual stress. The results are given of dimensional changes taking place in the panels under accelerated thermal cycling and outdoor aging conditions; these results are compared to an analytical model of the laminate. In addition, the sheet molding compound is examined for thermomechanical properties and flow behavior in the rib sections. Results indicated that lowering the thermal expansion coefficient of the sheet molding compound through material modifications would produce a more stable structure. DOE

N81-19614# Sandia Labs., Albuquerque, N. Mex. Experimental Systems Operations Div.

PUMP HEAT LOSS TEST REPORT

M. A. Quintana and L. E. Torkelson Jan. 1981 23 p

(Contract DE-AC04-76DP-00789)

(SAND-80-2526) Avail: NTIS HC A02/MF A01

A test is described which measures the heat loss from a centrifugal pump under both insulated and uninsulated conditions. Results showed a 27% reduction in loss by insulating the pump and seal not requiring liquid cooling. DOE

N81-19615# Sandia Labs., Livermore, Calif. Thermal Subsystems Div.

COST-PERFORMANCE COMPARISON OF WATER-STEAM RECEIVERS FOR SOLAR CENTRAL ELECTRIC POWER PLANTS

P. D. Laquil, C. T. Schafer, and S. E. Faas Dec. 1980 39 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-8245) Avail: NTIS HC A03/MF A01

An evaluation of the relative cost performance of large solar central receiver electric power plants utilizing water/steam receivers was performed. The investigation consisted of a systems integration of receiver conceptual designs from three major boiler manufacturers with advanced turbine conditions and thermal storage designs. The methodology and results of the evaluation are described. The results of the evaluation are described. The results indicate which combinations of receiver designs, storage types, and thermodynamic conditions hold promise for significant cost performance improvements when compared to first generation water/steam technology. DOE

N81-19616# Science Applications, Inc., McLean, Va.

HEAVY OIL RESERVOIRS RECOVERABLE BY THERMAL TECHNOLOGY Annual Report

Patrick Kujawa Feb. 1981 178 p Prepared in cooperation with DOE, Oakland, Calif.

(Contract DE-AC03-78ET-12380)

(DOE/ET-12380/1-Vol-1) Avail: NTIS HC A09/MF A01

Data are presented on reservoirs that contain heavy oil in the 8 to 25(0) API gravity range, contain at least ten million barrels of oil currently in place, and are noncarbonate in lithology. The reservoirs within these constraints were analyzed in light of applicable recovery technology, either steam drive or in situ combustion, and then ranked hierarchically as candidate reservoirs. An extensive basis for heavy oil development is provided, however, it is recommended that data on carbonate reservoirs, and tar sands be compiled. It was discovered that operators, and industrial and government analysts will lump heavy oil reservoirs as poor producers, however, it was found that upon detailed analysis, a large number, so categorized, were producing very well. A big problem in producing heavy oil is that of regulation; specifically, it was found that the regulatory constraints are so fluid and changing that one cannot settle on a favorable recovery and production plan with enough confidence in the regulatory requirements to commit capital to the project. DOE

N81-19617# Science Applications, Inc., McLean, Va.

HEAVY OIL RESERVOIRS RECOVERABLE BY THERMAL TECHNOLOGY Annual Report

P. Kujawa Feb. 1981 529 p refs

(Contract DE-AC03-78ET-12380)

(DOE/ET-12380/1-Vol-2) Avail: NTIS HC A23/MF A01

Reservoir, production, and project data for target reservoirs which contain heavy oil in the 8 to 25(0) API gravity range and are susceptible to recovery by in situ combustion and steam drive are presented. The reservoirs for steam recovery are less than 2500 feet deep to comply with state of the art technology. In cases where one reservoir would be a target for in situ

combustion or steam drive, that reservoir is reported in both sections. Data were collected from three source types: hands-on, once removed, and twice removed. In all cases, data were sought depicting and characterizing individual reservoirs as opposed to data covering an entire field with more than one producing interval or reservoir. The data sources are listed at the end of each case. A complete listing of operators and projects is included as well as a bibliography of source material. DOE

N81-19618# Midwest Research Inst., Golden, Colo. Systems Development Branch.
COMPARATIVE RANKING OF 0.1 TO 10 MW SUB E SOLAR THERMAL ELECTRIC POWER SYSTEMS. VOLUME 1: SUMMARY OF RESULTS Final Report
John P. Thornton, Kenneth C. Brown, Joseph G. Finegold, James B. Gresham, F. Ann Herlevich, John S. Kowalik, and Thomas A. Kriz Aug. 1980 151 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-351-461-Vol-1) Avail: NTIS HC A08/MF A01

The original objective of the study was to project the mid 1990 cost and performance of selected generic solar thermal electric power systems for utility applications and to rank these systems by considered plants with rated capacities of 1 to 10 MW sub e, operating over a range of capacity factors from the no storage case to 0.7 and above. The study was extended to include systems with capacities from 0.1 to 1 MW sub e, a range that is attractive to industrial and other non-utility applications. DOE

N81-19619# Midwest Research Inst., Golden, Colo.
MOD 2 WIND TURBINE DEVELOPMENT PROJECT
Oct. 1980 24 p refs
(Contract DE-AC02-77CG-00178)
(SERI/SP-732-728) Avail: NTIS HC A02/MF A01

A wind turbine to produce energy for less than 5 cents/kWh based on 1980 cost forecasts was designed. The pricing method used to project the Mod 2 energy costs is the levelized fixed charge rate approach, generally accepted in the electric utility industry as a basis for relative ranking of energy alternatives. This method derives a levelized energy price necessary to recover utility's purchasing, installing, owning, operating, and maintenance costs. DOE

N81-19620# Illinois Univ., Urbana. Dept. of Agricultural Engineering.
SURFACE-HEATING GREENHOUSES WITH WASTE HEATED WATER Final Report
P. N. Walker Dec. 1980 13 p refs Prepared in cooperation with Illinois Power Co., Decatur
(Contract DE-FG02-79R5-10107)
(DOE/R5-10107/T1) Avail: NTIS HC A02/MF A01

An aluminum framed glass greenhouse was constructed. The outside surface of this greenhouse was heated by flowing power plant cooling water over it. The water was applied at the ridge and allowed to run over the roof and sidewalls and into gutters where it was returned to the power plant's discharge canal. One season's heating performance data and resulting conclusions are presented. These results show that surface heating reduced conventional heat requirements by one third on the test greenhouse. However, when these results are projected to a commercial greenhouse the heating energy costs can be reduced by 67 percent. These cost savings would be 28 percent if 5 C cooler water were used and 90 percent if 5 C warmer water were used. DOE

N81-19621# Harvard Univ., Cambridge, Mass.
OPTIMIZATION OF TRANSPARENT ELECTRODE FOR SOLAR CELLS Technical Progress Report, 15 Sep. - 15 Dec. 1980
Roy G. Gordon 1980 9 p
(Contract DE-AC02-77CH-00178)
(SERI/PR-9318-1-T1) Avail: NTIS HC A02/MF A01

Films of fluorine-doped tin oxide were studied. The current research has as its goal further improvements in the properties of this transparent electrode material. The first phase of the work sought to find out what mechanisms limit the transparency and electrical conductivity of this material. It is suspected that certain chemical impurities, and also mechanical imperfections at boundaries between small grains in the films, may have deleterious effects. The second phase of the work attempted to minimize those deleterious factors which were identified in the first phase. Some samples of optimal films were made, under the best conditions obtained. Progress is summarized. DOE

N81-19622# California Univ., Los Angeles. School of Engineering and Applied Science.
TRANSPARENT GLASS HONEYCOMB STRUCTURES FOR ENERGY LOSS CONTROL Final Summary Report, Jan. 1976 - Oct. 1979
Jun. 1980 102 p refs
(Contract DE-FG03-76CS-31084; Grant EY-76-G-03-1084)
(UCLA-ENG-8039) Avail: NTIS HC A06/MF A01

It was demonstrated that properly shaped glass honeycomb placed between a nonselective absorber and the coverglass of a flat plate solar collector gives collection efficiencies significantly higher than those of conventional flat plate units, even those with selective absorbers, collecting solar energy at temperatures required for heating and cooling buildings. Three basic glass honeycomb shapes were analyzed and tested: thin walled cylindrical glass tube honeycomb in square or hexagonal arrays, corrugated thin glass sheets stacked peak to trough to form double sinsuoid shaped cells, and flat thin glass sheets stacked to form long parallel slots. DOE

N81-19623# Bendix Corp., Kansas City, Mo.
TESTING OF HEAT PIPES FOR COOLING A 425 DEG C INJECTION MOLD
K. T. Feldman, Jr., P. L. Marjon, and D. R. Hahn 1980 10 p refs Presented at the 19th Natl. Heat Transfer Conf., Orlando, Fla., 27 Jul. 1980
(BDX-613-2445; CONF-800723-25) Avail: NTIS HC A02/MF A01

In order to increase the production rate of a mold used to manufacture plastic parts, a mold cooling system was designed to use air cooled finned heat pipes. The cooling system was designed to cool the mold from 425 to 150(0) C (800 to 300(0) F) per minute. Candidate heat pipes were built and tested using 1.91 cm OD steel tube with spiral wound, welded, and segmented fins and with Dowtherm A working fluid. Eight vertical heat pipes, each with a measured overall thermal conductance of 2.00 W/(0) C, when fitted into holes in the mold, provide the 28(0) C minute cooling needed. DOE

N81-19624# Southern California Gas Co., Los Angeles.
PROJECT SAGE: SOLAR ASSISTED GAS ENERGY Final Report
Mar. 1980 219 p refs
(Grant NSF PTP-75-03457)
(DOE/TIC-11105; NSF/RA-790330/31) Avail: NTIS HC A10/MF A01

Plans are formulated to: improve solar assisted gas energy (SAGE) technical design and performance; reduce SAGE costs; refine SAGE market assessment; and identify policies to encourage the use of SAGE. Two SAGE water heating systems were installed and tested. One system was retrofit onto an existing apartment building; the other was installed in a new apartment building. Each installation required approximately 1000 square feet of collector area tilted to an angle of 37(0) from the horizontal, and each was designed to supply about 70 percent of the energy for heating water for approximately 32 to 40 units of a typical two-story apartment complex, in Southern California. Construction costs were compiled, and both installations were equipped with performance monitoring equipment. The operating and maintenance requirements of each installation was evaluated by gas company maintenance engineers. Market penetration was assessed by developing a computer simulation program using the technical and economic analysis from the installation experience. DOE

N81-19625# Centro Informazioni Studi Esperienze, Milan (Italy).
GaAs(GaAl)AS SOLAR CELLS TO BE USED UNDER CONCENTRATED SOLAR LIGHT CONDITION
G. Fabri and G. Fiorito Commission of the European Communities 1980 37 p refs Sponsored by Commission of the European Communities
(EUR-6934-EN) Avail: NTIS HC A03/MF A01

A LPE facility for growing GaAs-GaAlAs epitaxial structures suitable for solar cells was designed and constructed. This facility allows growths on substrates up to 4 sq cm in area and the use of solutions for several growths. After an investigation of GaAlAs and dopant phase diagrams, based on thermodynamic considerations, the growth critical parameters were set-up. A simple model analysis on the cell behavior allowed to identify the fundamental characteristics of both GaAs-GaAlAs structures and single layers. The obtained results evidenced the possibility of growing GaAs and GaAlAs layers with composition, doping and electric characteristics fitting solar cells. DOE

N81-19626# Acurex Corp., Mountain View, Calif. Alternate Energy Div.

SOLAR PRODUCTION OF INDUSTRIAL PROCESS HOT WATER: OPERATION AND EVALUATION OF THE CAMPBELL SOUP HOT WATER SOLAR FACILITY Final Report, 1 Sep. 1979 - 10 Dec. 1980

John I. Kull, William N. Neimeyer, and Stanley B. Youngblood Dec. 1980 162 p refs

(Contract DE-AC03-76CS-31218)

(SAN-1218-4) Avail: NTIS HC A08/MF A01

The operation and evaluation of a solar hot water facility is summarized. The period of evaluation was for 12 months from October 1979 through September 1980. The objective of the work was to obtain additional, long term data on the operation and performance of the facility. Minor modifications to the facility were completed. The system was operated for 15 months, and 12 months of detailed data were evaluated. The facility was available for operation and of the time during the last 8 months of evaluation. A detailed description of the solar facility and of the operating experience is given, and a summary of system performance for the 12 month operation/evaluation period is presented. Recommendations for large scale solar facilities based on this project's experience are given, and an environmental impact assessment is provided. DOE

N81-19627# National Water Well Association, Worthington, Ohio.

GROUND-WATER HEAT PUMPS: AN EXAMINATION OF HYDROGEOLOGIC, ENVIRONMENTAL, LEGAL, AND ECONOMIC FACTORS AFFECTING THEIR USE

Dana M. Armitage, Douglas J. Bacon, John T. Massey-Norton, and James M. Miller 12 Nov. 1980 26 p

(Contract DE-AC01-78CS-20060)

(DOE/CS-20060/5120-Exec-Summ) Avail: NTIS HC A03/MF A01

Factors affecting the use of ground water (well) are presented. First is the well cost and the availability of an adequate supply of suitable quality of well water. Second, the removal of significant quantities of well water without suitable recharge may deplete the underground aquifer. Plans to reinject or return the water underground may be precluded by legal restrictions. It could entail additional costs for the disposal well. Special provisions to prevent thermal alterations of the underground source may be required. These issues are addressed in the study and other questions are answered relating to ground water quality and availability, potential environmental effects, legal restrictions, and energy use and economics of ground water heat pump use. The main elements of the study and conclusions are summarized. Other topics briefly discussed are: ground water resources in the US; water source heat pump equipment; and energy use comparisons. Some data on heat pump in Atlanta, Birmingham, Cleveland, Columbus, Concord, Houston, Philadelphia, Seattle, and Tulsa are tabulated and graphically presented. Data of ground water heat pump water use and effluent disposal regulations by states are summarized. DOE

N81-19628# Motorola, Inc., Phoenix, Ariz. Solar Operations.

NEAR-TERM IMPLEMENTATION OF PROJECTION COST REDUCTIONS FOR PHOTOVOLTAIC CONCENTRATOR ARRAY Final Report, 18 Dec. 1978 - 7 Jan. 1980

L. Grenon Dec. 1980 43 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-7073) Avail: NTIS HC A03/MF A01

A chronological review of the process sequence is presented as well as an explanation of each process step and its production readiness status. Topics covered include: (1) evaluation of use of thin silicon substrates (7 mil); (2) selection of a wax material capable of protecting selected surfaces of the solar cell from attack by various chemical etches during processing; (3) evaluation of ion implantation processes and annealing techniques; (4) development of a fine surface texturing process for improved absorption of incident illumination; (5) provision for subsequent development of fine line front surface metallization patterning; (6) optimization of the metallization processes; and (7) determination of those parameters that must be tested in order to determine the quality of a finished concentrator solar cell. Processes that have evolved that have direct application to satisfying a near-term cost effective process sequence include plasma etching, plasma patterning, and evaluation of a lower cost nickel-copper metallization process. DOE

N81-19629# Plasma Physics Corp., Locust Valley, N. Y.

PLASMA-ASSISTED CVD OF FLUORINATED, HYDROGENATED AMORPHOUS SILICON Final Technical Report, 15 Sep. 1979 - 15 Sep. 1980

John H. Coleman, John P. Hammes, and Harold J. Wiesmann 1980 31 p refs Sponsored by Midwest Research Inst., Golden, Colo.

(Contract DE-AC02-77CH-00178)

(SERI/TR-8041-2-T1) Avail: NTIS HC A03/MF A01

Approximately 300 large-area PIN hydrogenated amorphous silicon (a-Si:H) solar cells were fabricated and tested. The a-Si:H PIN cells which were plasma deposited at 200 to 350 C were found to have high internal currents, whereas those which were deposited by CVD at 500 to 650 C had low internal currents. When corrected for optical losses in the top electrode, the internal quantum efficiency vs wavelength for the PIN cells indicated a peak value above 80% at about 525nm, which decreased monotonically to zero at about 725 nm. When the published values of the RCA and EXXON were corrected similarly for optical loss, nearly identical values of internal quantum efficiencies were found. DOE

N81-19630# Pacific Sun, Inc., Palo Alto, Calif.

SOLAR-HEATED HOT WATER INSTRUMENTATION PROJECT FOR EPRI HEADQUARTERS COMPLEX, PALO ALTO, CALIFORNIA Final Report

H. T. Whitehouse and P. Ortiz Jan. 1981 172 p refs

(EPRI Proj. 1191-1)

(EPRI-EM-1654) Avail: NTIS HC A08/MF A01

A data acquisition and analysis effort charted the performance of a solar assisted, hot water preheat system supplying a portion of the service water needs. Detailed load and performance data for the system are presented, the merits of the data acquisition system employed are discussed, and recommendations for future monitoring efforts are provided. DOE

N81-19631# Radiation Monitoring Devices, Inc., Watertown, Mass.

LOW COST SPRAYED CdTe SOLAR CELL RESEARCH Quarterly Report, 15 Nov. - 14 Feb. 1980

P. Sienkiewicz, S. Lis, M. G. Serreze, and G. Entine Mar. 1980 16 p refs Prepared for Midwest Research Inst., Golden, Colo.

(Contract EG-77-C-01-4042)

(DSE-4042-T34) Avail: NTIS HC A02/MF A01

Two approaches showed great promise. X-ray diffraction analysis showed that CdTe can be produced from solutions containing CdCl2 and (NH4) TeO4 with either hydrazine dihydrochloride or oxalic acid as the reducing agent. Films produced from the oxalic acid experiments yielded reducing agent. Films produced from the oxalic acid experiments yielded encouraging infrared scans, and as a result this approach received the most effort. In addition, good quality, photoconductive, CdS films were produced via traditional methods and characterized using optical and electrical measurements. Overall film uniformity for both CdS and CdTe was improved by the installation of a stainless steel, gravity fed, spray nozzle and mechanical linkage. DOE

N81-19632# Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.

HIGH-RELIABILITY GAS TURBINE COMBINED-CYCLE DEVELOPMENT PROGRAM, PHASE 1 Final Report

R. E. Strong, D. J. Amos, K. H. Eagle, and G. L. Francois Nov.

1980 362 p
(EPRI Proj. 1187-2)
(EPRI-AP-1598) Avail: NTIS HC A16/MF A01

The development of a conceptual centerline design of a highly reliable combustion turbine combined cycle (CTCC) electric power generating plant having the twin design availability goals of 0.95 for the combustion turbine (CT) engine and 0.90 for the combined cycle (CC) plant, together with a CT engine starting reliability of 0.99 is described. The work and results of six interrelated tasks are described: (1) reliability analyses of current CT engines/plants; (2) eight CT unit/CC plant reliability design trade off studies; (3) high reliability CT unit and CC plant conceptual designs; (4) definition of technology research projects required to complete development of the conceptual CTCC plant; (5) analyses of the conceptual designs to determine what modifications are required for peaking duty application and use of lower grade petroleum and coal derived fuels; and (6) analyses of installed and current design CT engines/CC plants to determine what retrofit modifications and design changes can be made to economically improve their availability. DOE

N81-19633# Rocketdyne, Canoga Park, Calif.
THERMAL STABILITY TESTS OF HEAT TRANSFER FLUIDS FOR TRANSFER AND STORAGE OF THERMAL ENERGY
G. R. Schneider Dec. 1980 142 p refs Prepared in cooperation with McDonnell Douglas Astronautics Corp., Huntington Beach, Calif.
(Contracts E4-76-C-03-1108; DE-AC03-76ET-20417)
(DOE/ET-20417/4; MDC-G9331) Avail: NTIS HC A07/MF A01

Laboratory tests were conducted to evaluate the high temperature (288 to 343 C) thermal stability, material compatibility, and surface fouling of selected commercial heat transfer fluids for a sensible heat thermal energy storage system to be used with a solar thermal electrical power generation plant. The tests provided information on the rate of fluid replenishment required, the change of viscosity, the composition of lost products, and the rate of fouling of heat transfer surfaces as a function of temperature and time. Determinations were made of the effect of the presence of materials likely to be used in the energy storage subsystem on these properties. DOE

N81-19634# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
CHEMICAL VAPOR DEPOSITION OF THIN-FILM POLYCRYSTALLINE Si FOR LOW COST SOLAR CELLS Quarterly Technical Progress Report, 2 Feb. - 2 May 1980
Ralph P. Ruth, William I. Simpson, Jane J. J. Yang, Lavada A. Moudy, and Richard E. Johnson May 1980 102 p refs
(Contract DE-AC03-79ET-23045)
(SAN-3045-3; QTPR-3) Avail: NTIS HC A06/MF A01

The program emphasized a study of the transport properties of p type polycrystalline Si films as functions of average grain size and impurity doping concentration. Preliminary investigations of nucleation and early stage growth phenomena in such films were carried out to provide improved understanding of the fundamental properties of the films that limit photovoltaic performance and thus to establish a good technical basis for subsequent attempts to achieve improved performance in solar cells using such films. Also, the study of transport properties was extended to n type polycrystalline Si films. DOE

N81-19635*# PRC Energy Analysis Co., Los Angeles, Calif.
SATELLITE POWER SYSTEM (SPS) PUBLIC OUTREACH EXPERIMENT
S. R. McNeal Dec. 1980 69 p refs Sponsored by NASA
(Contract DE-AC81-79ER-10041)
(NASA-CR-164022; DOE/ER-10041/T11) Avail: NTIS HC A04/MF A01 CSCL 10A

An outreach experiment was conducted to improve the results of the satellite power system (SPS) concept development and evaluation program. The objectives of the outreach were to: (1) determine the areas of major concern relative to the SPS concept and (2) gain experience with an outreach process for use in future public involvement. The response to the outreach effort was positive, suggesting that the effort extended by the SPS project division to encourage an information exchange with the public was well received. The responses were analyzed and from them some questions and answers about the satellite power system are presented. E.D.K.

N81-19636# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
STUDY OF WIND ENERGY CONVERSION SYSTEMS (WECS) IN A FARM AREA AND WECS SAFETY LIMIT REQUIREMENTS. MINUTES FROM EXPERT MEETING IEA, RESEARCH AND DEVELOPMENT WECS, ANNEX ONE, SUBTASK A1
Sigge Eggwertz Jun. 1980 114 p refs Partly in ENGLISH and DUTCH Proceedings of IEA WECS Sub-Task A1 Meeting, Stockholm, 25 Feb. 1980
(Contract SWEDBESD-5060-601)
(FFA-TN-HU-2218) Avail: NTIS HC A06/MF A01

The proceedings include the description of two 2500 kW windmill prototypes, safety studies performed in several countries, and a contribution concerning fault tree analysis and load case recommendations. The introduction of safe zone, the crack detection system, and operation during icing conditions are discussed. Author (ESA)

N81-19637# Atomic Energy Commission Research Establishment, Riso (Denmark). Physics Dept.
ANALYSIS OF DATA FROM THE GEDSER WIND TURBINE: 1977 TO 1979
P. Lundsager, S. Frandsen, and C. J. Christensen Aug. 1980 137 p refs Sponsored by Danish Ministry of Energy, Danish Electric Utilities and Danish Ship Research Lab.
(RISOE-M-2242; ISBN-87-550-0693-0; ISSN-0418-6435)
Avail: NTIS HC A07/MF A01

Power characteristics based on 10 min averages, coherence between measurements of wind and electric power based on high speed scanning, drive train oscillations and structural response of the rotor on a 200 kW windmill are analyzed. Theoretical models are developed and evaluated. The measurements are summarized and a Gedser Wind turbine on Easter Island is compared to other Danish, Swedish and American experimental wind turbines. Author (ESA)

N81-19638# AEG-Telefunken, Wedel (West Germany). Fachbereich Neue Technologien, Raumfahrt.
A 10 kW SMALL SOLAR POWER STATION AND OPERATIONS OPTIMIZATION Final Report
Joachim Gloel Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 123 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-139; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

Characteristics of the plant are: unpressurized hot water (95 C) for transport and storage of thermal energy; screw expansion engine operating with freon R114 for thermomechanical energy conversion; and an ac three phase generator interconnected with a static converter to provide line voltages and frequencies. A solar collector simulator was used in testing. Selection, assembly, and function of the system and each subsystem are detailed. Component performance results are listed. Component by component operation optimization results show the importance of correctly regulating the thermal cycle temperature as well as the freon expansion pump circuit pressure. Author (ESA)

N81-19639# Bonn Univ. (West Germany). Inst. fuer Physikalische Chemie.
ELECTRODES AND DIAPHRAGMS FOR FUEL CELLS Final Report
Wolf Vielstich, Hermann Schladitz, and Ernst Knauf (Physikalische-Chemie Forschungslabor) Bundesministerium fuer Forschung und Technologie Dec. 1979 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-140; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Polycrystalline electrodes made up of iron whiskers or nickel whiskers were investigated for application in water electrolysis and supporting material in fuel cells. For fuel cell studies an asbestos polymer separator was used. Electrodes of

different thickness and having layers of different catalysts were studied. The best results were obtained with the nickel-whisker electrode which was used as an anode and a cathode in half cells. The nickel-whisker electrode was sintered in an H2 atmosphere at 800 C, in 2mm thick, and has a porous volume of 70%. Whisker electrodes had to be covered by platings when they were used in a glycol-air fuel cell. The activity of these electrodes is strongly dependent on platinum layer formation and on the nature of the supporting material. Author (ESA)

N81-19640# Swedish Council for Building Research, Stockholm.
A SOLAR HEATING PLANT IN STUDSVIK: DESIGN AND FIRST YEAR OPERATIONAL PERFORMANCE
Rutger Roseen and Bengt Perers 1980 98 p
(PB81-114480; ISBN-91-540-3265-2) Avail: NTIS HC A05/MF A01 CSCL 13A

Group solar heating plants offer one of the most promising ways of economically utilizing solar energy for space heating purposes. A relatively advanced prototype installation was built at Studsvik on the Swedish east coast south of Stockholm. The installation is based on a cheap, excavated and insulated water store with a floating insulating cover. The solar collectors are mounted on the cover, which turns to track the Sun. This increases the efficiency of the concentrating collectors by between 30 and 50 percent. The heat is used as the sole heat source for an adjacent office building, designed for low temperature heating. GRA

N81-19641# National Bureau of Standards, Washington, D.C.
LIFE-CYCLE COST MANUAL FOR THE FEDERAL ENERGY MANAGEMENT PROGRAM Final Report
Rosalie T. Ruegg Dec. 1980 240 p refs Sponsored in part by DOE
(PB81-136269; NBS-HB-135) Avail: NTIS HC A11/MF A01 CSCL 05C

The manual is a guide to understanding the life cycle costing method and an aid to calculating the measures required for evaluating energy conservation and renewable energy investments in all Federal buildings. It expands upon life cycle costing criteria contained in the Program Rules of the Federal Energy Management Program (Subpart A of Part 436, Title 10, U.S. Code of Federal Regulations) and is consistent with those criteria. Its purpose is to facilitate the implementation of the Program Rules by explaining the life cycle costing method defining the measures, describing the assumptions and procedures to follow in performing evaluations, and giving examples. GRA

N81-19642# Swedish Council for Building Research, Stockholm.
A SWEDISH GROUP SOLAR HEATING PLANT WITH SEASONAL STORAGE: TECHNICAL-ECONOMIC DESCRIPTION OF THE LAMBOHOV PROJECT
Kjell Norbaeck and Jonas Hallenberg 1980 49 p refs
(PB81-123374; ISBN-91-540-3331-4) Avail: NTIS HC A03/MF A01 CSCL 13A

The group solar heating plant described was built to provide 55 terraced houses in Lambohov with energy for space heating and the production of domestic hot water. Solar collectors mounted on the roofs of the houses supply hot water to an excavated water store blasted into the bedrock. The solar collectors pick up energy from February to October. The solar energy collected suffices to meet about 88 to 95 percent of the annual energy requirements. GRA

N81-19643# Swedish Council for Building Research, Stockholm.
CONTINUOUS HEAT SOURCE MODEL FOR GROUND HEAT STORAGE
Johan Claesson and Mats Johansson 1980 32 p refs
(PB81-122889; ISBN-91-540-3323-3; D34-1980) Avail: NTIS HC A03/MF A01 CSCL 13B

The ground volume is penetrated by a duct system for injection and extraction of heat. The heat transfer properties between the ground and such a system is here characterized by a heat transfer length. The heat exchange between the soil and the ducts is represented by a heat source/sink distribution in the storage region. GRA

N81-19644# Swedish Council for Building Research, Stockholm.
SWEDISH ENERGY STORAGE PROJECTS 1979: RESEARCH-DEVELOPMENT-FULL-SCALE EXPERIMENTS SUPPORTED BY GOVERNMENTAL ORGANIZATIONS
Stellan Atterkvist 1980 144 p refs
(PB81-122947; ISBN-91-540-3257-1; D19-1980) Avail: NTIS HC A07/MF A01 CSCL 10C

The material contains 94 projects. Projects included: general studies and comparisons of storage methods; sensible storage in water; sensible storage in ground and rock; sensible storage in parts of building structures; latent storage; thermochemical storage; batteries; storage of hydrogen. GRA

N81-19645# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY MARKET STUDY ON THE ATLANTIC COASTAL PLAIN. DEFINITION OF MARKETS FOR GEOTHERMAL ENERGY IN THE NORTHERN ATLANTIC COASTAL PLAIN
William J. Toth May 1980 218 p refs
(Contract EX-76-A-36-1008)
(PB81-123861; JHU/APL/GEMS-002; JHU/APL/QM-80-075) Avail: NTIS HC A10/MF A01 CSCL 05C

The cost and revenue streams for each year in the lifetime of a geothermal energy conversion project are calculated by the Geothermal Resource Interactive Temporal Simulation (GRITS) computer program. The program gives preliminary economic evaluations of projects under a wide range of resource, demand, and financial conditions. T.M.

N81-19646# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY MARKET STUDY ON THE ATLANTIC COASTAL PLAIN. GRITS: A COMPUTER PROGRAM FOR THE ECONOMIC EVALUATION OF DIRECT-USE APPLICATIONS OF GEOTHERMAL ENERGY
William Barron, Peter Kroll, Richard Weissbrod, and William J. Toth Jun. 1980 84 p refs
(Contract EX-76-A-36-1008)
(PB81-119786; JHU/APL/QM-80-077; JHU/APL/GEMS-008; MCGER-80-002) Avail: NTIS HC A05/MF A01 CSCL 05C

The Geothermal Resource Interactive Temporal Simulation (GRITS) model calculates the cost and revenue streams for each year in the lifetime of a project that utilizes low to moderate temperature geothermal resources. With these two estimates, the net present value of the project can be determined for each year. The GRITS model allows preliminary economic evaluations of direct use applications of geothermal energy under a wide range of resource, demand, and financial conditions, some of which change over the lifetime of the project. GRA

N81-19647# Franklin Research Center, Philadelphia, Pa.
HOT WATER FROM THE SUN: A CONSUMER GUIDE TO SOLAR WATER HEATING
Beth McPherson May 1980 115 p refs Sponsored in part by DOE and HUD
(PB81-128597; HUD-0001752; HUD/PDR-548) Avail: NTIS HC A06/MF A01 CSCL 13A

Consumer information and guidance are provided relating to solar heating of water for residential use. Information to help the homeowner decide whether to install a solar hot water system is provided. The components which make up a solar hot water system, the various kinds of systems available, and the benefits and limitations of each type are discussed. The physical orientation of the house, site vegetation, and ways to determine if the house has enough sunlight to make good use of the Sun are also analyzed. The elements of cost in a solar energy system are outlined, and a method is provided to help the reader estimate whether a solar unit is justified. GRA

N81-19648# American Planning Association, Chicago, Ill.
RESIDENTIAL SOLAR DESIGN REVIEW: A MANUAL ON COMMUNITY ARCHITECTURAL CONTROLS AND SOLAR ENERGY USE
Martin Jaffe and Duncan Erley Jul. 1980 87 p refs Sponsored in part by DOE, Washington, D.C.
(Contract HUD-H-2573)
(PB81-128605; HUD-0001753; HUD/PDR-579) Avail: NTIS HC A05/MF A01 CSCL 13A

Intended primarily for members of private architectural review

committees working for homeowners' associations, this guidebook examined some of the design review committees to solar installations and buildings in relation to existing aesthetic goals in their communities. The guide describes typical solar energy systems and explains why they look the way they do. Design alternatives for highlighting, concealing, and integrating solar equipment into buildings were examined. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-19649*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE 1979 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY. VOLUME 1: DESCRIPTION OF EXPERIMENTS AND SELECTED AIRCRAFT DATA

Gerald L. Gregory, Robert B. Lee, III, and Joe J. Mathis, Jr. Feb. 1981 72 p refs

(NASA-TM-81860-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13B

The Southeastern Virginia Urban Plume Study (SEV-UPS) utilizes remote sensors and satellite platforms to monitor the Earth's environment and resources. SEV-UPS focuses on the application of specific remote sensors to the monitoring and study of specific air quality problems. The 1979 SEV-UPS field program was conducted with specific objectives: (1) to provide correlative data to evaluate the Laser Absorption spectrometer ozone remote sensors; (2) to demonstrate the utility of the sensor for the study of urban ozone problems; (3) to provide additional insights into air quality phenomena occuring in Southeastern Virginia; and (4) to compare measurement results of various in situ measurement platforms. The field program included monitoring from 12 surface stations, 4 aircraft, 2 tethered balloons, 2 radiosonde release sites, and numerous surface meteorological observation sites. The aircraft monitored O3, NO, NOx, Bscat, temperature, and dewpoint temperature. S.F.

N81-19650*# College of William and Mary, Williamsburg, Va. Dept. of Geology.

MINERALOGICAL, OPTICAL, GEOCHEMICAL, AND PARTICLE SIZE PROPERTIES OF FOUR SEDIMENT SAMPLES FOR OPTICAL PHYSICS RESEARCH

Karen Bice and Stephen C. Clement Feb. 1981 23 p refs (Contract NAS1-16042)

(NASA-CR-165663) Avail: NTIS HC A02/MF A01 CSCL 13B

X-ray diffraction and spectroscopy were used to investigate the mineralogical and chemical properties of the Calvert, Ball Old Mine, Ball Martin, and Jordan Sediments. The particle size distribution and index of refraction of each sample were determined. The samples are composed primarily of quartz, kaolinite, and illite. The clay minerals are most abundant in the finer particle size fractions. The chemical properties of the four samples are similar. The Calvert sample is most notably different in that it contains a relatively high amount of iron. The dominant particle size fraction in each sample is silt, with lesser amounts of clay and sand. The indices of refraction of the sediments are the same with the exception of the Calvert sample which has a slightly higher value. Author

N81-19651*# National Aeronautics and Space Administration, Washington, D. C.

SOCIO-PSYCHOLOGICAL AIRPLANE NOISE INVESTIGATION IN THE DISTRICTS OF THREE SWISS AIRPORTS: ZURICH, GENEVA AND BASEL

R. Graf, R. Mueller, and H. P. Meier Sep. 1980 359 p refs Transl. into ENGLISH of "Sozio-psychologische Flughaefen Zuerich, Genf, Basel" Bern, Switerland, May 1974 p 1-405 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75787) Avail: NTIS HC A16/MF A01 CSCL 13B

The results of noise measurements and calculations are available in the form of noise maps for each of the three areas. To measure the stress due to airplane noise the Noise and Number Index (NNI) was applied. In the vicinities of the airports, 400 households were randomly selected in each of the three noise zones (of 10 NNI intervals each). A total of 3939 questionnaires could be evaluated, one quarter of which came from areas without airplane noise. Concurrently, traffic noise was measured in areas of Basel and expressed in sum total levels L sub 50 and the reaction of 944 persons was elicited by interrogation. T.M.

N81-19652# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Offshore Energy Technology.

ENVIRONMENTAL EXPOSURE AND DESIGN CRITERIA FOR OFFSHORE AND GAS STRUCTURES

May 1980 230 p refs

(Contract N00014-76-C-0309)

(AD-A094651) Avail: NTIS HC A11/MF A01 CSCL 08/9

One of the tasks of the Committee on Offshore Energy Technology was to review the availability of engineering field data, methods, and procedures for adequately describing and interpreting the environmental conditions that go into criteria for the design, verification, and inspection of offshore oil and gas structures. Accordingly, the committee examined how industry obtains environmental data, how it uses the data to evaluate environmental exposures, and how it uses environmental exposures to establish criteria to design, build, install, and operate offshore platforms. The committee examined all three phases of developing offshore petroleum reserves: pre-lease, exploration, and production. The purpose was to find where and what types of data were needed by government and industry. GRA

N81-19653# Argonne National Lab., Ill. Energy and Environmental Systems Div.

LOCAL AIR QUALITY CONSTRAINTS ON ENERGY GROWTH, 1985-1990

D. G. Streets Mar. 1980 65 p refs

(Contract W-31-109-eng-38)

(ANL/EES-TM-114) Avail: NTIS HC A04/MF A01

This report examined the potential future conflict between energy growth and environmental protection from the perspective of siting constraints imposed by requirements of the Clean Air Act Amendments of 1977. County-level projections of additional utility powerplant capacity and increases in industrial coal, oil, and gas consumption were derived for the period 1985 to 1990. Emissions of sulfur dioxide and particulate matter, after the application of appropriate control systems, were converted to changes in ambient air quality using a proportional modeling approach. These changes were then compared with Nonattainment and Prevention of Significant Deterioration requirements, and the energy activity is considered to be constrained if a violation is projected. Total percentages of constrained energy activity were developed for the nation, and the geographical patterns of significant impacts are presented. Author

N81-19654# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluation Group.

APPLICATION OF DIVERSITY TO REGIONAL ECOLOGICAL ASSESSMENT: A REVIEW WITH RECOMMENDATIONS

James B. Levenson and Forest W. Stearns (Wisconsin Univ., Milwaukee) Mar. 1980 41 p refs

(Contract W-31-109-eng-38)

(ANL/AA-21) Avail: NTIS HC A03/MF A01

Species diversity is frequently considered a primary indicator of ecosystem health, stability, and resilience. As such, species diversity is commonly the major criterion upon which environmental impact statements and ecological assessments are based. The theoretical development and refinement of the concept of ecological diversity and the various mathematical expressions of diversity are described. Advantages and disadvantages of each diversity expression are discussed. The application and interpretation of diversity indexes for different spatial scales (e.g., specific sites and regional assessments) and variables (e.g., species diversity, habitat diversity, landscape diversity) are contrasted. Recommentations indicate the appropriate diversity indexes for regional ecological assessments. DOE

N81-19655# Ames Lab., Iowa.
AIR POLLUTION CONTROL TECHNOLOGY FOR MUNICIPAL SOLID WASTE-TO-ENERGY CONVERSION FACILITIES: CAPABILITIES AND RESEARCH NEEDS
Joseph F. Lynch and James C. Young Sep. 1980 53 p refs
(Contract W-7405-eng-82)
(DOE/EV-0115) Avail: NTIS HC A04/MF A01

Three major categories of waste to energy conversion processes in full scale operation or advanced demonstration stages in the US are co-combustion, mass incineration, and pyrolysis. These methods are described and some information on US conversion facilities was tabulated. Conclusions and recommendations dealing with the operation, performance, and research needs for these facilities are given. Research needs concerning air pollution aspects of the waste to energy processes were identified and significant operating and research findings for the co-combustion, mass incineration, and pyrolysis waste to energy systems were reviewed. DOE

N81-19656# Department of Energy, Washington, D. C. Assistant Secretary for Environment.
RESEARCH ISSUES AND SUPPORTING RESEARCH OF THE NATIONAL PROGRAM ON CARBON DIOXIDE, ENVIRONMENT AND SOCIETY, FISCAL YEAR 1980
Jan. 1981 176 p
(DOE/EV-0129) Avail: NTIS HC A09/MF A01

The research conducted in the United States under the auspices of the CO2 program is outlined. The program encompasses six primary categories which, in turn, are divided into 18 research subcategories and 51 research issues. The research program was designed to describe the research which should be conducted regardless of institutional or even national sponsorship. Project descriptions were collected and classified according to the research issue to which they most directly apply and were inserted immediately following the applicable issue description. This provides, for the first time, a detailed view of the nation's effort in addressing the carbon dioxide question in FY 1980. DOE

N81-19657# State Univ. of New York, Buffalo. Lab. for Power and Environmental Studies.
INVESTIGATION OF ACOUSTIC AEROSOL AGGLOMERATION MECHANISMS UNDER TRAVELING-WAVE CONDITION Progress Report, 1 Jul. - 30 Sep. 1980
David T. Shaw 16 Oct. 1980 40 p refs
(Contract DE-AC21-79MC-11842)
(DOE/MC-11842/T4) Avail: NTIS HC A03/MF A01

Acoustically induced turbulence and shock waves in a traveling wave tube were investigated with and without the introduction of an air flowing through the system. Frequency (f) and intensity (I) effects of the acoustic field were studied using a hot film anemometer and FFT data processing unit. The effect of the acoustically induced turbulence on a laminar flow was also investigated. Sampled data were conditioned and processed to estimate the characteristics of turbulence. It is found that for sound pressure level >158 dB, turbulence appears. At slightly higher level (approx. 160 dB) shock waves appear over the range of all frequencies. Turbulence measurements were performed over a frequency range of 500 to 2200 Hz, with intensity over a range of 0.6 to 4.0 W/cm(2). Below I = 0.6 W/cm(2) no turbulent bursts were found. The turbulent spectrum F and the wave number k were found to satisfy a power law F proportional to k/sup (ALPHA)/ with (ALPHA) approx. 1.7 to 2.1. DOE

N81-19658# GCA Corp., Bedford, Mass.
ACID RAIN INFORMATION BOOK Final Report
Dec. 1980 229 p
(Contract DE-AC01-79EV-10273)
(DOE/EV-10273/1) Avail: NTIS HC A11/MF A01

A preliminary assessment is given of various aspects of the acid rain phenomenon. Particular attention is placed on natural and manmade sources of acid rain as well as their transport and eventual deposition by atmospheric processes. Both the adverse and the sometimes beneficial effects of the deposition of these materials are discussed. Areas of uncertainty in information related to acid are also identified. R.C.T.

N81-19659# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
MICROCHEMICAL CHARACTERIZATION OF AEROSOLS
T. Novakov Oct. 1980 38 p refs Presented at the 8th Intern. Microchem. Symp., Graz, 25-30 Aug. 1980
(Contract W-7405-eng-48)
(LBL-11805) Avail: NTIS HC A03/MF A01

A methodology was developed to quantitate the amounts of different classes of carbonaceous aerosol particulates collected at various urban locations in the United States. The analysis of the results provides an assessment of the relative amounts of primary and secondary particulate carbon at these locations. Carbonaceous particles in the atmosphere consist of two major components - graphitic or black carbon (sometimes referred to as elemental or free carbon) and organic material. Two approaches were used in these studies. The first essentially involved a systematic study of 24 h average black carbon to total carbon ratios, since measurements of this ratio from a number of source samples give insights into the relative black to total carbon ratio of primary emissions and the source variabilities. The second approach was dependent on the evolved gas (CO2) thermal analysis method as a means of identifying the organic and black carbon components of source emissions, source enriched samples, and ambient particles. DOE

N81-19660# West Virginia Univ., Morgantown. Coll. of Engineering.
PARTICULATE SAMPLING IN TURBULENT DUCT FLOWS Final Report
R. A. Bajura, S. A. Lutz, J. B. Stenger, J. G. Svinos, and P. Bekowies Nov. 1980 126 p refs
(Contract DE-AC21-77MC-09087)
(DOE/MC-08087/T1) Avail: NTIS HC A07/MF A01

The purpose of this research program was to identify sources of error in the measurement of gas/particulate aerosols using sampling probes. The program included: conducting a literature review and developing an analytical model for treating the errors in sampling measurements under turbulent, anisokinetic flow conditions; performing experimental studies to determine the measurement error for particles in the respirable range; and, reviewing the status of various optical methods for in situ measurements of both particle size and concentration. DOE

N81-19661# Northwestern Univ., Evanston, Ill.
CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM
R. M. Garrels and F. T. Mackenzie Jan. 1981 56 p refs Presented at the Some Aspects of the Role of the Shallow Ocean in Global Carbon Dioxide Uptake Conf., Atlanta, 20 Mar. 1980 Prepared for Gas Research Inst., Chicago
(Contract DE-AC02-80EV-10372)
(CONF-8003115) Avail: NTIS HC A04/MF A01

The purpose of the workshop was to assess the role of the oceanic mixed layer, especially the shallow waters of shelves, seas, and estuaries, as a sink or source for atmospheric carbon dioxide. Most preceding studies have involved waters well away from shore and have not considered processes such as organic carbon production and storage in shelf sediments or in sediments of estuaries, or chemical interactions of CO2 with carbonates in sediments or with suspended particles of the shallow ocean. Therefore, the Workshop was convened to assess the importance of such processes and to make recommendations for further work on those aspects of CO2 storage that seemed important in the controls of atmospheric carbon dioxide. DOE

N81-19662*# Environmental Protection Agency, Research Triangle Park, N.C.
ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM-CONCEPT DEVELOPMENT AND EVALUATION PROGRAM-MICROWAVE HEALTH AND ECOLOGICAL EFFECTS
Nov. 1980 146 p refs Sponsored by NASA
(Contract DE-AT01-79ER-10035)
(NASA-CR-164021; DOE/ER-10035/2) Avail: NTIS HC A07/MF A01 CSCL 13B

Potential health and ecological effects of the microwave beam from the microwave power transmission system (MPTS) of the satellite power system (SPS) are discussed. A detailed critical

review of selected scientific articles from the published literature on the biological effects of nonionizing electromagnetic radiation is provided followed by an assessment of the possible effects of the SPS, based on exposure values for the reference system. DOE

N81-19663# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
ACID RAIN
Jul. 1980 36 p refs
(EPA-600/9-79-036) Avail: NTIS HC A03/MF A01
The current state of knowledge concerning acid precipitation, its sources, composition, environmental transport, and effects on living organisms, is summarized. DOE

N81-19664# Electric Power Research Inst., Palo Alto, Calif.
ACID PRECIPITATION: THE COMPLEXITY OF A PERCEIVED PROBLEM
Robert W. Brocksen Feb. 1980 17 p refs Presented at the 24th Am. Public Power Assoc. Ann. Engr. and Operations Workshop, Phoenix, Ariz., 25 Feb. 1980
(CONF-800264-8) Avail: NTIS HC A02/MF A01
Biogeological processes are being examined as part of an environmental physics and research program designed to further understanding of the sources, formation, transport, deposition, and effects of acid rain. Field studies on three watersheds in the Adirondack Mountains that contain lakes with differing levels of acidity should provide data on the effects of acid rain on aquatic biota and on the production of crops, forests, and grasslands. In-cloud processed, regional air quality studies, and the formation of sulfate aerosols in power plant plumes are also under investigation. DOE

N81-19665# Automation Industries, Inc., Silver Spring, Md. Vitro Lab. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Dec. 1980 245 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-80/12) Avail: NTIS HC A11/MF A01
The solar sites are grouped into 12 zones, each of which consists of several adjacent states. The solar energy sites are in alphabetical sequence within each zone. The tables provide available meteorological data for reporting sites in the NSDN as follows: Insolation - the insolation table presents the total, diffuse, direct, maximum, and extra-terrestrial radiation for the solar site. It also shows the ratio of total extra-terrestrial radiation, as a percent. Temperature - the temperature table gives the average daytime, nightime, maximum, minimum and inlet water temperatures for the solar site. Additional tables are presented for some of these NSDN sites, supplying either wind or relative humidity data, or both. DOE

N81-19666# Toxicology Information Response Center, Oak Ridge, Tenn.
HEALTH AND ENVIRONMENTAL EFFECTS OF ACID RAIN. AN ABSTRACTED LITERATURE COLLECTION, 1968 1979
N. S. Dailey and S. G. Winslow Mar. 1980 206 p Prepared in cooperation with National Library of Medicine
(Contract W-7405-eng-26)
(NLM/TIRC-80/1) Avail: NTIS HC A10/MF A01
The long distance transport and ultimate deposition of acidic contaminants along air sheds has made acid precipitation both a regional problem and an international concern. This abstracted bibliography contains 961 citations on the health and environmental effects of acid precipitation. Contaminants of primary interest are sulfuric and nitric acids, sulfates and nitrates, and ammonium. The research directory, which can be found at the end of the bibliography, contains information concerning current research projects including the title of the project, organization conducting the research, principal investigator, sponsor, and supplementary material with a brief project description. DOE

N81-19667# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
PROCEDURES FOR THE PREPARATION OF EMISSION INVENTORIES FOR VOLATILE ORGANIC COMPOUNDS, VOLUME 1
William H. Lamason, II Sep. 1980 206 p refs
(PB81-120164; EPA-450/2-77-028-2) Avail: NTIS HC A10/MF A01 CSCL 13B
Procedures are described for compiling emission inventories of volatile organic compounds for use in less data intensive models such as roll back and the Empirical Kinetic Modeling Approach. Such inventories generally represent annual emissions (perhaps with some seasonal information) and are compiled for larger geographical areas such as counties. The basic inventory elements, planning, data collection, emission estimates, and reporting are all discussed. No single prescriptive methodology is presented; rather, a set of procedures is described so that the agency may choose the most appropriate techniques to meet its needs in its ozone program. Various examples are included to aid the agency in the understanding and utilization of this document. GRA

N81-19668# *University of South Florida, Tampa.*
GASEOUS AND PARTICULATE AMMONIA AND NITRIC ACID CONCENTRATIONS, COLUMBUS, OHIO AREA: *SUMMER 1980*
Robert S. Braman, Timothy J. Shelley, and William McClenny (Environmental Sciences Research Lab., Research Triangle Park, N.C.) Dec. 1980 34 p refs
(Grant EPA-R-806688)
(PB81-125007; EPA-600/7-80-179) Avail: NTIS HC A03/MF A01 CSCL 07D
Data is presented for gaseous ammonia and nitric acid and particulate ammonium ion and nitrate ion concentrations in air samples collected in support of the PEPE-NEROS study during the summer of 1980. Ground level samples were collected near Croton, Ohio; aerial samples were also taken from an aircraft during several flights. Sampling and analyses were accomplished using the hollow and packed tube tungstic acid method that permits short sampling times of 10-30 minutes. Feasibility of sampling from aircraft was established. Quality control was maintained by measuring the preconcentration tube efficiency before and during field analysis. GRA

N81-19669# Environmental Protection Agency, Research Triangle Park, N.C. Quality Assurance Div.
EVALUATION OF OZONE CALIBRATION PROCEDURES Final Report
Kenneth A. Rehme, John C. Puzak, Michael E. Beard, and C. Frederick Smith Nov. 1980 227 p refs
(PB81-118911; EPA-600/4-80-050) Avail: NTIS HC A11/MF A01 CSCL 07D
Four alternative calibration methods were investigated as possible replacements: the ultraviolet photometry procedure, the gas phase titration with excess nitric oxide procedure, the gas phase titration with excess ozone procedure, and the boric acid-potassium iodide procedure. Each method was subjected to a preliminary investigation to review the procedural descriptions and to assess the critical performance parameters. The ultraviolet photometry procedure was determined to be the most dependable and accurate and was designated the replacement procedure. GRA

N81-19670# *Delaware Univ., Newark.* Dept. of Civil Engineering.
WATER QUALITY DEGRADATION DUE TO *NON-POINT POLLUTION FROM URBAN SOURCES* Final Report, Oct. 1977 - Mar. 1979
J. B. Carberry Jan. 1980 81 p refs
(Contract DI-14-34-0001-8070; OWRT Proj. B-018-DEL)
(PB81-124364; W81-00339; OWRT-B-018-DEL(3)) Avail: NTIS HC A05/MF A01 CSCL 13B
A study of the concentrations of cadmium and lead in the Christiana River in the Newark, Delaware area showed that lead pollution originates from airborne automotive exhausts, while cadmium pollution originates from surface stormwater runoff. Four complete storm events were sampled for streamwater degradation analysis at five different sampling stations. Stream sediments and soils suspended during a storm event have significant adsorption capacity. Hydraulic dispersion and stochastic models were used to describe stream responses to storm events. GRA

N81-19671# Oklahoma State Univ., Stillwater. School of Civil Engineering.
CONTROL OF POLLUTION IN WATERS CONTAINING HEAVY METALS Completion Report, 1 Oct. 1978 - 30 Sep. 1980
Don F. Kincannon, Marcia Bates, and Richard N. DeVries Sep. 1980 97 p refs
(Contract DI-14-34-0001-8038)
(PB81-124133; W81-00323; OWRT-A-087-OKLA(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

An integrated set of experiments were carried out on the fate of chromium and copper in biological waste water treatment processes, aqueous environments, and soil systems. A rotating biological contactor and activated sludge were used as the waste water treatment processes; Stillwater, Oklahoma area lake and river water and sediments, as the aqueous environments; and sandy and red silty clay soils, as the soil systems. GRA

N81-19672# Little (Arthur D.), Inc., Cambridge, Mass.
METAL PARTICULATE EMISSIONS FROM STATIONARY SOURCES. VOLUME 1: STANDARD SAMPLING AND ANALYSIS METHOD Final Report
Edward T. Peters, James R. Valentine, and Jeffrey W. Adams Dec. 1980 103 p refs
(Contract EPA-68-02-1219)
(PB81-120024; EPA-600/2-80-202) Avail: NTIS HC A06/MF A01 CSCL 07D

A program was undertaken to develop reliable methods for measuring trace elements in emission streams. This program concerns a sampling and analysis method for arsenic, cadmium, chromium, cobalt, manganese, nickel, lead, selenium, and vanaduim. Based upon a review of the literature, atomic absorption spectrophotometry was selected as the analysis method for all metals. To approximate a stationary source, a simulation system consisting of a fuel oil combustion chamber and stack with sampling ports was constructed. Known amounts of metals were introduced to the system as organometallic additives to the fuel. GRA

N81-19673# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
AIR QUALITY DATA: 1979 ANNUAL STATISTICS, INCLUDING SUMMARIES WITH REFERENCE TO STANDARDS
Sep. 1980 275 p refs
(PB81-123093; EPA-450/4-80-014) Avail: NTIS HC A12/MF A01 CSCL 13B

This report presents comprehensive summaries of data produced by the nation's ambient air quality monitoring activities for 1979. The data are summarized in two formats: frequency distributions and status of data with reference to standards. These summaries are based on data acquired through extensive monitoring activities conducted by Federal, state, and local pollution control agencies and submitted to the U.S. Environmental Protection Agency's National Aerometric Data Bank. GRA

N81-19674# Calspan Advanced Technology Center, Buffalo, N.Y.
AEROSOL FORMATION FROM DIESEL EXHAUST AND SO2, A CHAMBER STUDY Final Report, Sep. 1978 - Mar. 1980
R. J. Anderson and J. T. Hanley Dec. 1980 110 p refs
(Contract EPA-68-02-2987)
(PB81-121147; EPA-600/3-80-095) Avail: NTIS HC A06/MF A01 CSCL 13B

Dilute diesel emission systems were studied in a 600 cu m indoor smog chamber under various conditions likely to be encountered in an urban environment. Aerosol formation and growth in an irradiated diesel emission/SO2/propylene system was primarily attributed to sulfate formation. During irradiated experiments, the rate of SO2 oxidation experienced a maximum of about 5 percent/hr in the period when the O3 concentration was increasing rapidly. Following the peak in the O3 concentration, the rate of SO2 oxidation decreased to about 1 percent/hr. GRA

N81-19675# Rockwell International Corp., Creve Couer, Mo. Environmental Monitoring and Services Center.
REGIONAL AIR POLLUTION STUDY: EFFECTS OF AIRBORNE SULFUR POLLUTANTS ON MATERIALS Final Report
F. Mansfeld Jan. 1980 180 p refs
(Contract EPA-68-02-2093)
(PB81-126351; EPA-600/4-80-007) Avail: NTIS HC A09/MF A01 CSCL 13B

Samples of galvanized steel, weathering steel, Al 2014 and 7079 stress samples, silver, marble, nylon and two types of house paint were exposed at nine sites. Wind speed and direction, temperature, dew point, total sulfur, SO2, H2S, O3, NOx, total hydrocarbons, total suspended particulate matter, sulfate and nitrate were recorded. For galvanized steel a pronounced effect of time of first exposure was observed. The corrosion behavior of weathering steel was not seasonally dependent. House paint showed discontinuous erosive behavior. GRA

N81-19676# PEDCo-Environmental, Inc., Durham, N.C.
VALIDATION OF AIR MONITORING DATA
A. Carl Nelson, Jr., Dave W. Armentrout, and Ted R. Johnson Jun. 1980 135 p refs
(Contract EPA-68-02-2722)
(PB81-112534; EPA-600/4-80-030; PEDCo-3320-N) Avail: NTIS HC A07/MF A01 CSCL 13B

Data validation refers to those activities performed after the data was obtained and thus serves as a final screening of the data before they are used in a decision making process. This report provides organizations that are monitoring ambient air levels and stationary source emissions with a collector of data validation procedures and with criteria for selection of the appropriate procedures for the particular application. Both hypothetical and case studies and several examples are given to illustrate the use of the procedures. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see 93 Space Radiation.

N81-19677*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
***POSTSEISMIC REBOUND DUE TO CREEP OF THE LOWER* LITHOSPHERE AND ASTHENOSPHERE**
Steven C. Cohen Feb. 1981 16 p refs Submitted for publication
(NASA-TM-82089) Avail: NTIS HC A02/MF A01 CSCL 04A

Postseismic surface deformations are attributed to the inelastic flow of the subcrustal regions of the Earth following an earthquake. A multilayer representation of the Earth's rheological properties is used in conjunction with a finite element computational scheme to calculate time dependent displacements and strains subsequent to a strike slip earthquake. The deviatoric stress strain relations for the uppermost layer is assumed elastic. Lower layers are assumed to be, in order of increasing depth, a standard, linear, three element, viscoelastic solid; a linear viscoelastic fluid; and another elastic solid. Physically these layers correspond to the upper lithosphere, lower lithosphere, asthenosphere, and lower mantle, respectively. Elastic dilatational properties are assumed throughout. Appreciable postseismic displacements, possibly approaching meters, for large earthquakes, arise from viscoelastic relaxation following sudden coseismic slip. Furthermore, compared to the simpler case of an elastic lithosphere over a viscoelastic asthenosphere and the near fault postseismic shear, strain is increased, by a factor of two or more in some cases, by the presence of a viscoelastic lower lithosphere. Also, the duration of postseismic straining is increased by the relatively slow relaxation of this layer. Author

N81-19678*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STOCHASTIC-DYNAMIC MODEL FOR GLOBAL ATMOSPHERIC MASS FIELD STATISTICS
M. Ghil, R. Balgovind (Sigma Data Services Corp.), and E. Kalnay-Rivas Jan. 1981 62 p refs

(Grants NsG-5034; NsG-5130)
(NASA-TM-82009) Avail: NTIS HC A04/MF A01 CSCL 04A

A model that yields the spatial correlation structure of atmospheric mass field forecast errors was developed. The model is governed by the potential vorticity equation forced by random noise. Expansion in spherical harmonics and correlation function was computed analytically using the expansion coefficients. The finite difference equivalent was solved using a fast Poisson solver and the correlation function was computed using stratified sampling of the individual realization of F(omega) and hence of phi(omega). A higher order equation for gamma was derived and solved directly in finite differences by two successive applications of the fast Poisson solver. The methods were compared for accuracy and efficiency and the third method was chosen as clearly superior. The results agree well with the latitude dependence of observed atmospheric correlation data. The value of the parameter c sub o which gives the best fit to the data is close to the value expected from dynamical considerations.
E.D.K.

N81-19679*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ONE-DIMENSIONAL MODELS OF QUASI-NEUTRAL PARALLEL ELECTRIC FIELDS
David P. Stern Feb. 1981 98 p refs Submitted for publication
(NASA-TM-82088) Avail: NTIS HC A05/MF A01 CSCL 04A

Parallel electric fields can exist in the magnetic mirror geometry of auroral field lines if they conform to the quasineutral equilibrium solutions. Results on quasi-neutral equilibria and on double layer discontinuities were reviewed and the effects on such equilibria due to non-unique solutions, potential barriers and field aligned current flows using as inputs monoenergetic isotropic distribution functions were examined. T.M.

N81-19680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GLOBAL TECTONIC ACTIVITY MAP WITH ORBITAL PHOTOGRAPHIC SUPPLEMENT
Paul D. Lowman, Jr. Jan. 1981 122 p refs Presented at 26th Intern. Geol. Congr., Jul. 1980
(NASA-TM-82073) Avail: NTIS HC A06/MF A01 CSCL 08B

A three part map showing equatorial and polar regions was compiled showing tectonic and volcanic activity of the past one million years, including the present. Features shown include actively spreading ridges, spreading rates, major active faults, subduction zones, well defined plates, and volcanic areas active within the past one million years. Activity within this period was inferred from seismicity (instrumental and historic), physiography, and published literature. The tectonic activity map was used for planning global geodetic programs of satellite laser ranging and very long base line interferometry and for geologic education. T.M.

N81-19681*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC SPACE-BASED FIELD MEASUREMENTS
Robert A. Langel Mar. 1981 19 p refs
(NASA-TM-82104) Avail: NTIS HC A02/MF A01 CSCL 08G

Because the near Earth magnetic field is a complex combination of fields from outside the Earth of fields from its core and of fields from its crust, measurements from space prove to be the only practical way to obtain timely, global surveys. Due to difficulty in making accurate vector measurements, early satellites such as Sputnik and Vanguard measured only the magnitude survey. The attitude accuracy was 20 arc sec. Both the Earth's core fields and the fields arising from its crust were mapped from satellite data. The standard model of the core consists of a scalar potential represented by a spherical harmonics series. Models of the crustal field are relatively new. Mathematical representation is achieved in localized areas by arrays of dipoles appropriately located in the Earth's crust. Measurements of the Earth's field are used in navigation, to map charged particles in the magnetosphere, to study fluid properties in the Earth's core, to infer conductivity of the upper mantels, and to delineate regional scale geological features. A.R.H.

N81-19682*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
ATMOSPHERIC STUDIES RELATED TO AEROSPACE ACTIVITIES AND REMOTE SENSING TECHNOLOGY Final Contractor Report, Aug. 1979 - May 1980
N. D. Sze, R. G. Isaacs, M. Ko, and M. B. McElroy Washington, D.C. NASA Mar. 1981 143 p refs
(Contract NAS1-15943)
(NASA-CR-3410) Avail: NTIS HC A07/MF A01 CSCL 04A

Parallel investigations were conducted relating to: the sensitivity of 1-D photochemical model simulated column ozone perturbations due to a projected fleet of 1000 aircraft cruising 7 hours per day at altitudes of 15-16 and 18-19 km to uncertainties in kinetic rate constant data determining modeled OH concentrations and eddy diffusivity profile parameterization and a comparison of the inherent strengths and weaknesses of Eulerian and Langrangian averaging processes in the development of multidimensional models and investigation of approaches to applying the Generalized Lagrangian Mean (GLM) formalism to zonal-mean models. The role of multiple scattering and Earth curvature in the evaluation of diurnally dependent photodissociation rates and trace species variations was examined. T.M.

N81-19683# Science Applications, Inc., Oak Brook, Ill.
ATMOSPHERIC TRIATOMIC MOLECULAR STUDIES Final Report, 1 Mar. 1978 - 31 May 1980
A. C. Wahl and J. H. Detrich 17 Nov. 1980 45 p refs
(Contract F49620-78-C-0050; AF Proj. 2301)
(AD-A094434; SAI-1-230-00-414) Avail: NTIS HC A03/MF A01 CSCL 07/4

A systematic study at the SCF and MCSCFCI level has been made of several of the fifteen triatomic atmospheric molecules which have formed the focus on this and previous work. In addition a powerful new multiconfiguration self consistent Field (MCSCF) method has been developed and partially implemented. Also, in order to achieve accurate electron affinities and ionization potentials, a new scheme for configuration selection has been developed called the differential correlation energy method. This method has been tested on the processes CN yields CN(-) and CO2(-) yields CO2. GRA

N81-19684# Naval Research Lab., Washington, D. C. Plasma Physics Div.
SPREAD F THEORIES: A REVIEW
S. L. Ossakow 30 Jan. 1981 48 p Sponsored in part by Defense Nuclear Agency
(RR0330244)
(AD-A095033; NRL-MR-4435) Avail: NTIS HC A03/MF A01 CSCL 04/1

Our understanding of equatorial spread F (ESF) phenomena has increased dramatically over the past few years: notwithstanding the fact that it was discovered over four decades ago (BOOKER and WELLS, 1938) as diffuse echoes on ionograms. Much of this advancement in understanding comes from a combined theoretical and experimental approach to the problem. Advances in radar backscatter measurements, satellite and rocket in situ measurements, and theoretical and numerical simulation techniques have provided a clearer picture of the fundamental mechanisms causing ESF. The study of ESF phenomena has been both complicated and enriched by the fact that the attendant magnetic field aligned ionospheric irregularities span some 5-6 orders of magnitude in scale sizes. The present paper will deal with ESF theory and at that only those theories using plasma mechanisms as a basis. Experimental reviews of the subject can be found in other papers in this edition. An examination is made of the basic equatorial nighttime ionospheric F region geometry. GRA

N81-19685# Naval Research Lab., Washington, D. C. Plasma Physics Div.
NONLINEAR THEORY AND EXPERIMENTAL OBSERVATIONS OF THE LOCAL COLLISIONAL RAYLEIGH-TAYLOR INSTABILITY IN A DESCENDING EQUATORIAL SPREAD-F IONOSPHERE Interim Report
M. J. Keskinen, E. P. Szuszczewicz, S. L. Ossakow, and J. C.

Holmes 8 Jan. 1981 39 p refs
(AD-A094723; NRL-MR-4399) Avail: NTIS HC A03/MF A01 CSCL 04/1

The nonlinear evolution of the local collisional Rayleigh-Taylor instability in downward-moving equatorial F layers has been studied in a coordinated theoretical and experimental program dealing with actual conditions of bottomside spread F. For ambient bottomside electron density gradient scale lengths L = 8 and 25 km, we find large percentage depletions and inverse power law spatial power spectra over the intermediate wavelength range wavelength = 25 m-1 km. In addition we outline a nonlinear theory of the collisional Rayleigh-Taylor instability applicable to an upward or downward moving equatorial F region ionosphere. These results represent the first definitive comparison between experiment and theory with their agreement lending further support to the belief that the collisional Rayleigh-Taylor instability is responsible for large scale size irregularities that occur under conditions of equatorial spread F. GRA

N81-19686# Battelle Columbus Labs., Ohio. Dept. of Electrical Engineering.
PARTIAL REFLECTION EXPERIMENT: OPERATIONAL AND DATA REDUCTION TECHNIQUES Final Report
W. A. Flood Oct. 1980 31 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1L1-61102-B-53A)
(AD-A095129; ERADCOM/ASL-CR-80-0100-4) Avail: NTIS HC A03/MF A01 CSCL 04/1

Operational and analytical procedures for reducing D-region partial reflection data obtained at White Sands Missile Range (WSMR) were reviewed and analyzed with the expectation that this equipment would be used to deduce D-region electron density profiles during the total solar eclipse of 26 February 1979 in Canada. The procedures devised as the result of this study are applicable to data obtained during the eclipse at a Canadian site as well as to data obtained during longer term operation at WSMR. GRA

N81-19687# Rondout Associates, Inc., Stone Ridge, N.Y.
REGIONAL SEISMIC WAVE PROPAGATION Final Report, 15 Dec. 1977 - 30 Sep. 1980
Paul W. Pomeroy and Thomas C. Chen 30 Nov. 1980 96 p refs
(Contract F49620-78-C-0043; ARPA Order 3297; AF Proj. 3291)
(AD-A094644; Rept-03-80-3; AFOSR-81-0073TR) Avail: NTIS HC A05/MF A01 CSCL 08/11

In a review of studies on the seismic phase Lg, its particle motion, dispersion, spectral content, mode of propagation, and magnitude scale are described; the regional velocity, attenuation, and propagation efficiency for this seismic phase was tabulated. The characteristics of Lg-wave propagation in the eastern and western United States are compared with those in different regions of the Soviet Union. Possible discriminants such as Lg vs. P amplitudes, Lg/P amplitude ratios as a function of distance, group velocities of Lg at amplitude maxima, and Lg energy ratios are found, similar to attenuation and group velocity, to be highly dependent on the propagation path. GRA

N81-19688# SACLANT ASW Research Center, La Spezia (Italy).
SEISMIC INTERFACE WAVES IN COASTAL WATERS: A REVIEW
Dieter Rauch NATO 15 Nov. 1980 105 p refs
(AD-A095018; SACLANTCEN-SR-42) Avail: NTIS HC A06/MF A01 CSCL 20/1

The basic elements of seismic wave propagation in the upper sea floor are presented, special emphasis being devoted to the often neglected interface phenomena (Scholte and Stonsley waves). The most important theoretical approaches to the seismic sensing of waterborne sound are discussed briefly and a great deal of the pertinent field work since World War II is reviewed. Some guidelines are given for future research activities in this interdisciplinary field, which combines the low frequency regime of underwater acoustics and the high frequency regime of seismology. An extensive biological is provided. GRA

N81-19689# Scientex Corp., Washington, D.C.
AN ANALYSIS OF THE VERTICAL DISTRIBUTION OF OZONE IN THE ATMOSPHERE Final Report
Allen G. Hansen and Stephen J. Padgett 31 Dec. 1980 90 p refs
(Contract N00173-80-M-3579)
(AD-A094823; TSC-11-1; NRL-MR-4398) Avail: NTIS HC A05/MF A01 CSCL 04/1

An analysis of vertical ozone distributions in the atmosphere is presented in tabular and graphical form for altitudes up to 25 kilometers. Histograms and concentrations probabilities are used to quantify the ozone distribution. The analysis is limited to the consideration of the probabilities of ozone concentration occurrence obtained by lumping the data for all times and locations. Limitations are discussed and recommendations are made with regard to further analysis for the determination of concentration variations with location and time. GRA

N81-19690# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
OZONE MEASUREMENTS TO 48 km WITH CHEMILUMINESCENT OZONE DETECTORS Annual Progress Report, 15 Nov. 1979 - 15 Jan. 1981
James M. Rosen and D. J. Hofmann Jan. 1981 5 p
(Contract N00014-76-C-0170; NR Proj. 211-151)
(AD-A094795; AP-62) Avail: NTIS HC A02/MF A01 CSCL 07/4

An airborne ozone measuring system was flown to 48 km on a large light weight balloon. Excellent data was obtained throughout the flight and the results indicate that this may be an effective method of obtaining ozone profiles to high altitudes. GRA

N81-19691# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
THE INFLUENCE OF AEROSOLS ON THE ELECTRICAL PARAMETERS IN THE FREE ATMOSPHERE Final Report, 1 Jan. 1977 - 31 Dec. 1980
J. M. Rosen and D. J. Hofmann Jan. 1981 6 p
(Grant DAAG29-77-G-0046)
(AD-A095149; ARO-14048.5-GS) Avail: NTIS HC A02/MF A01 CSCL 04/1

A comparison of all past measurements of the vertical profile of the small ion concentration shows that there is a significant discrepancy between observers. The research described here centered around resolving these disagreements which at first was thought due to the presence of aerosols. The problem was attacked by developing a reliable ion counter and then obtaining simultaneous ion density and aerosol profiles. In addition, an international workshop was held for the purpose of simultaneously comparing the many instruments and techniques used in atmospheric electrical measurements. GRA

N81-19692# Los Alamos Scientific Lab., N. Mex.
EARTHQUAKE CATALOG FOR NORTHERN NEW MEXICO Progress Report, Sep. 1973 - Dec. 1979
D. J. Wechsler, D. J. Cash, K. H. Olsen, N. J. McFarland, and J. J. Wolff Oct. 1980 36 p refs
(Contract W-7405-eng-36)
(LA-8579-PR) Avail: NTIS HC A03/MF A01

This report is a summary of the earthquakes in northern New Mexico located by the Los Alamos Scientific Laboratory seismic array. Data are presented in the form of tables and epicenter maps, with a brief explanatory text. DOE

N81-19693# Massachusetts Inst. of Tech., Cambridge.
MAGNETOTELLURIC INTERPRETATIONS IN A CRUSTAL ENVIRONMENT Final Report
Theodore R. Madden 1980 16 p refs
(Contract DE-AS02-77ET-28357)
(DOE/ET-28357/1) Avail: NTIS HC A02/MF A01

Problems that arise in interpreting magnetotelluric measurements in complex geological environments are approached by considering the low frequency approximation where the upper crust can be considered a thin layer of varying conductivity. The formulation of the thin layer problem is modified to allow resistive coupling between the upper crust and the mantle. A new parameter arises, called the adjustment distance, which is the distance required for the current to readjust itself between the upper crust and the mantle when changes in crustal conductivity are encountered. This distance is given by the square root of the

product of the integrated conductivity and the integrated resistivity across the crust (and some of the upper mantle). Layered media interpretations made on magnetotelluric data from areas that are closer to a conductivity boundary than the adjustment distance can be very misleading. Since the adjustment distance is often greater than 100 km, one has to consider more complex modeling in many situations. In order to simplify the modeling of the large region dictated by the adjustment distance, the concept of a multiple scale analysis to the thin layer calculations was applied. A simple interpretation of actual field data from the Snake River Plains is given which illustrates the adjustment distance effect on magnetotelluric fields. DOE

N81-19694# Los Alamos Scientific Lab., N. Mex.
EARTHQUAKE CATALOG FOR NORTHERN NEW MEXICO Progress Report, Jul. - Sep. 1980
D. J. Wechsler, D. J. Cash, K. H. Olsen, N. J. Farland, and J. J. Wolff Jan. 1981 14 p refs
(Contract W-7405-eng-36)
(LA-8687-PR) Avail: NTIS HC A02/MF A01

This report is a summary of the earthquakes in northern New Mexico located by the Los Alamos National Laboratory seismic array. Data are presented in the form of tables and epicenter maps, with a brief explanatory text. DOE

N81-19695# Los Alamos Scientific Lab., N. Mex.
EARTHQUAKE CATALOG FOR NORTHERN NEW MEXICO Progress Report, Apr. - Jun. 1980
D. J. Wechsler, D. J. Cash, K. H. Olsen, N. J. McFarland, and J. J. Wolff Dec. 1980 12 p refs
(Contract W-7405-eng-36)
(LA-8614-PR) Avail: NTIS HC A02/MF A01

This report is a summary of northern New Mexico earthquakes located by the Los Alamos Scientific Laboratory seismic array. Data are presented in the form of tables and epicenter maps, with a brief explanatory text. DOE

N81-19696# California Univ., Livermore. Lawrence Livermore Lab.
SEISMIC WAVES IN HORIZONTALLY STRATIFIED HALF-SPACE
L. Thigpen 14 Nov. 1980 35 p refs
(Contract W-7405-eng-48)
(UCRL-53072) Avail: NTIS HC A03/MF A01

A reflectivity method for computing synthetic seismograms was modified to include both body and surface waves from a buried source in a layered half space. The vertical displacements were computed for various structures at different source locations to elucidate numerical difficulties encountered with the reflectivity method. Portions of the seismograms were interpreted in terms of reflected, refracted, and surface waves. DOE

N81-19697# California Univ., Livermore. Lawrence Livermore Lab.
USE OF COMPUTER-SIMULATED RADIANCES TO RETRIEVE TOTAL ATMOSPHERIC OZONE DATA FROM SATELLITE-MOUNTED INFRARED MULTIFILTER RADIOMETERS
P. P. Weidhaas Oct. 1980 18 p refs Presented at the 14th Ann. Simulation Symp., Tampa, Fla., 16-20 Mar. 1981 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84352; CONF-810305-1) Avail: NTIS HC A02/MF A01

Four satellites equipped with multichannel filter radiometer (MFR) sensors supplied infrared radiance data at various spectral channels. An ozone retrieval model was developed in order to derive total ozone values from the radiance data. Statistical comparison against a network of ground observatories which measure total ozone with a Dobson spectrophotometer showed good agreement between MFR derived ozone data and Dobson measurements. Thus, the scientific feasibility of the ozone retrieval model was established. Currently, SOAC has begun to automate the processing and archiving of the MFR data. R.C.T.

N81-19698# Brookhaven National Lab., Upton, N. Y.
ATMOSPHERIC BOUNDARY LAYER PROCESSES DURING A TOTAL SOLAR ECLIPSE
S. SethuRaman, A. Prabhu, K. Narahari Rao, and R. Narasimha 1980 3 p refs Presented at the 5th Symp. on Turbulence, Diffusion, and Air Pollution, Atlanta, 9 Mar. 1981 Prepared in Cooperation with Indian Inst. of Science, Bangalore
(Contract DE-AC02-76CH-00016)
(BNL-28555; CONF-810306-5) Avail: NTIS HC A02/MF A01

The total solar eclipse that occurred over the southern part of India on February 16, 1980, gave a unique opportunity to study the Earth's atmospheric boundary layer. The meteorological experiments during the 1980 solar eclipse were conducted at Raichur, India (16(0)12'N, 77(0)21'E) located in the state of Karnataka, approximately 400 m above sea level. The changes in the Earth's atmosphere during and immediately after the eclipse were studied including the changes in the momentum and heat fluxes in the boundary layer due to the eclipse. Measurements were made for 2 days prior to and 1 day after the day of the eclipse to determine background characteristics of the boundary layer which might be site dependent. DOE

N81-19699# Sandia Labs., Albuquerque, N. Mex. Geothermal Research Div.
KILAUEA IKI LAVA LAKE EXPERIMENT PLANS
J. C. Dunn and R. G. Hills Jan. 1981 64 p refs
(SAND-80-1653) Avail: NTIS HC A04/MF A01

Twelve experimental studies are proposed to complete field laboratory work at Kilauea Iki lava lake. Of these twelve experiments, eleven do not require the presence of melt. Some studies are designed to use proven techniques in order to expand our existing knowledge, while others are designed to test new concepts. Experiments are grouped into three main categories: geophysics, energy extraction, and drilling technology. Each experiment is described in terms of its location, purpose, background, configuration, operation, and feasibility. DOE

N81-19700# URS/Blume (John A.) and Associates, San Francisco, Calif.
PROBABLE EARTHQUAKE GROUND MOTION AS RELATED TO STRUCTURAL RESPONSE IN LAS VEGAS, NEVADA
Roger W. Greensfelder, Frederick C. Kintzer, and Malcolm R. Somerville Dec. 1980 140 p refs
(Contract DE-AC08-76DP-00099)
(JAB-00099-120) Avail: NTIS HC A07/MF A01

Ground motion parameters are necessary for structural damage assessments and dynamic effects prediction in Las Vegas, Nevada. To develop these, a model of tectonic activity in the southern Basin and Range province was constructed on the basis of late Cenozoic patterns of crustal deformation, estimates of regional strain rates in Holocene time, and historic seismicity. From this information, the region surrounding Las Vegas was subdivided into six seismotectonic zones. Magnitude-recurrence relationships were developed for each of the six seismotectonic zones and probable maximum values of peak ground acceleration in Las Vegas were calculated using a computer program (HAZARD). Probable causative earthquake magnitudes in each source zone, probable values of duration of seismic shaking, and predominant periods likely to be associated with various peak accelerations were also determined. DOE

N81-19701# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTINENTAL NETWORKS: REPORT ON THE ACTIVITIES OF THE IAG-COMMISSION X FROM 1975 TO 1979
Rudolf Sigl 1979 60 p refs Presented at Intern. Assoc. of Geodesy (IAG), Canberra, Australia, 2-15 Dec. 1979
(Ser-B-243; ISBN-3-7696-8536-9; ISSN-0065-5317) Avail: NTIS HC A04/MF A01

Activities for the establishment of uniform systems of geodetic control points are reported. Working methods are discussed. Subcommission activity reports include European triangulation, European leveling and other geodetic work. The definition and importance of continental networks are discussed. Problems with the establishment of geodetic networks using terrestrial observation as well as satellite geodesy are analyzed and proposals for possible solutions are presented. Author (ESA)

N81-19702# Austrian Solar and Space Agency, Vienna.
THE ESTIMATION OF GLOBAL AND SKY RADIATION ON

HORIZONTAL AND INCLINED SURFACES IN AUSTRIA
F. Neuwirth (Central Inst. for Meteorology and Geodynamics), M. Bruck, W. Heindl (Bureau of Applied Mathematics, Vienna), and G. Schaffar (Techische Hochschule, Vienna) Oct. 1979 62 p refs
(ISBN-3-7041-0052-8) Avail: NTIS HC A04/MF A01

The spatial and temporal distribution of global solar radiation on a horizontal surface were determined using sunshine duration data. Maps showing the seasonal and yearly radiation sums for all of Austria are shown. Factors were computed for calculating the radiation sums on arbitrarily inclined and oriented surfaces.
Author (ESA)

N81-19703# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
DERIVED MID-LATITUDE NO DENSITIES
M. Friedrich and F. M. Torkar Mar. 1979 27 p refs
(Grant ACSR-2671)
(INW-7903) Avail: NTIS HC A03/MF A01

Nitric oxide densities were derived from measured electron densities and other atmospheric parameters for the period of the Western Europe Winter Anomaly Campaign 1975/76. The validity of this method was checked directly by comparison with measured NO profiles.
Author (ESA)

N81-19704# Graz Univ. (Austria). Inst. fuer Nachrictentechnik und Wellenausbreitung.
VARIATION OF DERIVED NO-PROFILES AT HIGH AND MID-LATITUDES
M. Friedrich and K. M. Torkar Sep. 1979 33 p refs Presented at 6th European Geophys. Soc. Ann. Meeting, Vienna, Sep. 1979 Supersedes INW-7903
(Contract ACSR-2671)
(INW-7908; INW-7903) Avail: NTIS HC A03/MF A01

Rocket electron density data from a sunrise campaign at a high latitude are used to estimate NO concentration, whereas additional temperature and groundbased data are available for the midlatitude case. The results show that this type of analysis, however valuable at midlatitudes, is not easily applicable at high latitudes due to the inevitable presence of particle precipitation even on days carefully selected for low activity by ground based instruments.
Author (ESA)

N81-19705# National Center for Atmospheric Research, Boulder, Colo. Advanced Study Program.
AIR MOTIONS IN A ROTATING SPHEROIDAL SHELL
Max Margules Oct. 1980 183 p refs Transl. into ENGLISH from Trans. of the Acad. Sci. (Vienna), v. 101, 1892 p 597-626, v. 102, 1893 p 11-56, and p 1369-1421
(Grant NSF ATM-77-23757)
(PB81-124653; NCAR/TN-156) Avail: NTIS HC A09/MF A01 CSCL 04B

Translations of three papers on atmospheric oscillations are presented. The effects of frictional dissipation on large-scale atmospheric oscillations are discussed.
L.F.M.

N81-19706# Illinois Univ. at Urbana-Champaign. Atmospheric Research Lab.
MODELING THE EVOLUTION OF THE CONVECTIVE PLANETARY BOUNDARY LAYER Final Report
Wen-Yih Sun and Yoshi Ogura Feb. 1980 54 p refs
(Grant NOAA-04-7-022-44026)
(PB81-116014; NOAA-80091904) Avail: NTIS HC A04/MF A01 CSCL 04A

The Level 3 turbulence closure model is modified (a) to incorporate the formulations for the turbulence third order moments and pressure terms proposed by Zeman and Lumley (1976) and (b) to introduce turbulence length scales which depend upon the stratification of the atmosphere. The vertical heat and moisture fluxes and the temperature humidity covariance are determined from differential equations. The model includes two other differential equations, one for the turbulence kinetic energy and the other for virtual potential temperature variance. All other turbulence variables are determined from algebraic equations. The model is used to simulate the daytime evolution of the planetary boundary layer observed on day 33 of the Wangara boundary layer experiment.
GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-19707# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
CARBON CYCLES AND CLIMATE: A SELECTED BIBLIOGRAPHY, VOLUME 1
Jerry S. Olson, Linda J. Allison, and Bobbie-Neil Collier May 1980 41 p Sponsored by DOE
(ORNL/EIS-108/V1) Avail: NTIS HC A03/MF A01

This partially annotated bibliography contains the first 1000 references from a computerized file of literature on the global ecological implications of carbon cycles and climatic changes. Two main topics are included: carbon cycling and climate system analysis. The carbon cycling categories include biology, geochemistry, global cycling models, terrestrial ecosystems, and organic components. Climate system analysis emphasizes models and covers the factors and feedbacks which modify projections of global and regional climatic change. Also included are effects of climate, such as paleoclimatic records (pollen, tree rings, and migrations) of actual past impacts, and plausible ecological and agricultural responses.
S.F.

N81-19708# Defence Research Information Centre, Orpington (England).
CALCULATION OF THE PROTECTIVE EFFECTS OF LIGHTNING CONDUCTORS AND TOWER STRUCTURES
F. Schwab Nov. 1980 24 p refs Transl. into ENGLISH from Bull. SEV (West Germany), v. 56, no. 17, 1965 p 678-683
(DRIC-T-6221; BR76775) Avail: NTIS HC A02/MF A01

The final striking distance between a lightning head and an earthed object is calculated on the basis of the charge in the lightning channel. This is then used to determine the lightning capture zone and the relative strike rate of tower structures. The protective effects of various lightning conductor arrangements and the permissible mesh aperture on Faraday cages are derived.
Author

N81-19709*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VAS DEMONSTRATION SOUNDING WORKSHOP: THE PROCEEDINGS OF A SATELLITE SOUNDING WORKSHOP
Daniel L. Endres, ed. and Louis W. Uccellini, ed. 1980 83 p refs Conf. held at Goddard Space Flight Center, Greenbelt, Md., 15 Jul. 1980
(NASA-CP-2157) Avail: NTIS HC A05/MF A01 CSCL 04B

Retrieval techniques that yield satellite derived temperature and moisture profiles are considered, with emphasis on TIROS-N and VISSR atmospheric sounder measurements. Topics covered include operational sounding, colocation concepts, correcting cloud errors, and the First GARP Global Experiment. For individual titles, see N81-19710 through N81-19716.

N81-19710*# National Environmental Satellite Service, Madison, Wis.
OPERATIONAL SOUNDING ALGORITHMS
William L. Smith *In* NASA. Goddard Space Flight Center VAS Demonstration Sounding Workshop 1980 p 1-10 refs (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

The analytical equations used to interpret TIROS-N sounding radiances for operational applications are presented. Both the National Environmental Satellite System (NESS) Global Operational Synoptic Scale and the NESS/University of Wisconsin (UW) North American Mesoscale Sounding Production Systems are considered.
Author

N81-19711*# National Oceanic and Atmospheric Administration, Silver Spring, Md.
IMPROVEMENTS TO SATELLITE RETRIEVAL SYSTEMS. THE OPERATIONAL PERSPECTIVE
Larry McMillin *In* NASA. Goddard Space Flight Center VAS Demonstration Sounding Workshop 1980 p 11-18 refs (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

Operational weather satellites are built as a series of nearly identical instruments which are flown for 5 to 7 years. Minor improvements are made during the life of the series. However, major improvements and changes in design are made with the initiation of a new series of instruments. Similarly, procedures used to process the data are characterized by frequent changes early in the life of a satellite series as user experience is gained with the new instrument. Later the changes become less frequent, both because the processing system becomes well tuned to that particular set of instruments and because, at the end of a series, resources are devoted to generating the processing system for the next set of instruments. Past and present systems are considered with emphasis on the vertical temperature profile radiometer and a procedure for deriving clear radiances in partly cloudy areas. A.R.H.

N81-19712*# National Meteorological Center, Washington, D. C.
EVALUATION AND USE OF TOVS RETRIEVALS AT NMC
Norman A. Phillips *In* NASA. Goddard Space Flight Center VAS Demonstration Sounding Workshop 1980 p 19-30 refs (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

In a current analysis procedure at the National Meteorological Center (NMC), a first guess analysis (from the latest 6 or 12 hour forecast) is updated by new data. In the newest analysis procedures, which are based on optimum interpolation, the observational correction depends on the size of preassigned, expected observational errors versus the size of expected errors in the first guess forecast. In the case of Northern Hemisphere ocean temperatures, the latter are around 2 degrees. The infrared satellite retrievals have a similar size 'error'. If (as assumed) their errors are uncorrelated with the first guess error, they will improve the analysis. The larger errors of the microwave retrievals, however, mean that they will be given little weight in the analysis. An evaluation of the TIROS-N retrievals is currently underway at NMC to determine the impact of satellite derived data within operational analysis schemes, to isolate possible problems within current retrieval methods, and to offer possible solutions for these problems. Author

N81-19713*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION OF NESS SOUNDINGS USED IN THE FGGE SPECIAL EFFORT
Robert Atlas *In its* VAS Demonstration Sounding Workshop 1980 p 31-40 refs (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

A special effort to produce high quality edited and enhanced global data sets is being conducted for the two special observing periods of the first GARP global experiment. More than 60 cases were selected for enhancement on the basis of meteorological interest. These cases include situations of blocking, cut off low development, cyclogenesis, and tropical circulations. The sounding data enhancement process consists of supplementing the operational satellite sounding data set with higher resolution sounding in meteorologically active regions and with new soundings where data voids or soundings of questionable quality exist. After the enhancement process is completed, a final editing and quality assessment of the enhanced data are performed. The data is archived for further analyses. Subjective evaluation of the effects of sounding data enhancement indicate that: (1) enhanced and operational IR retrievals are similar in most situations; (2) large improvements in 1000 to 300 mb thickness and mandatory level temperature and intensification of atmospheric thermal gradients occasionally occur; (3) interactive processing can fill in major gaps in the TIROS-N coverage; and (4) assimilation of special effort soundings can result in major modifications to large scale analyses and prognoses. A.R.H.

N81-19714*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GLAS PHYSICAL INVERSION METHOD FOR ANALYSIS OF TIROS N DATA
Joel Susskind and Joan Rosenfield (Sigma Data Services Corp., Silver Spring, Md.) *In its* VAS Demonstration Sounding Workshop 1980 p 41-55 refs (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

The Goddard Laboratory for Atmospheric Sciences approach to temperature sounding from satellite observations is fundamentally different from that of NESS in that heavy reliance is placed on the ability to model accurately the instrumental response to atmospheric and surface conditions, while no use is made of statistical relationships between satellite observations and atmospheric temperature profiles. The method involves starting with a guess set of atmospheric and surface conditions from which expected brightness temperatures for the satellite observations are computed. Then, iterative relaxation of atmospheric and surface conditions is performed according to the difference between observed and computed brightness temperatures until sufficient agreement is reached. In the absence of sufficient agreement, no retrieval is produced for that location. Author

N81-19715*# National Environmental Satellite Service, Madison, Wis.
LOW LEVEL MOISTURE FROM VAS
Christopher M. Hayden *In* NASA. Goddard Space Flight Center VAS Demonstration Sounding Workshop 1980 p 57-65 refs (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

Previous research and current opinion are too pessimistic concerning the capability of defining moisture fields from satellite measurements. The TIROS-N sounder is a close analogue to what will fly on GEOS-D and can be used to investigate the probable capability of VAS. Basically, there are three frequencies applied to sensing moisture in the troposphere. The ability of these three measurements to define the moisture pattern is assessed. It is certainly true that one cannot achieve the detail available with a radiosonde hygristor. Sharp discontinuities cannot be sensed by a passive sounder, especially since the measurement tends to 'saturate' with the first moisture layer encountered. However, the satellite measurements demonstrate a high degree of skill in defining the horizontal gradient. Moisture 'tongues' and 'dry lines' are readily delineated with some, perhaps two layers, of vertical definition. These attributes allow both the calculation of important advective quantities as well as (in concert with the temperature sounding) a gross definition of the vertical stability. The skill is demonstrably commensurate with subsynoptic forecast models and perhaps even to regional scale models. A.R.H.

N81-19716*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATISTICALLY CONDITIONED LEAST SQUARES RETRIEVALS PLANNED FOR THE VAS DEMONSTRATION EXPERIMENT
Dennis Chester *In its* VAS Demonstration Sounding Workshop 1980 p 67-79 (For primary document see N81-19709 10-47)
Avail: NTIS HC A05/MF A01 CSCL 04B

Problems in the retrieval of atmospheric profiles from passively observed satellite radiances are reviewed. Plans are described for statistically conditioned least squares retrievals of temperature and moisture profiles around mesoscale events, based upon the expected sensitivity of the VAS channels to the atmospheric variations. Simulated soundings for a global data set and for the 1976 National Severe Storm Laboratory (NSSL) severe storm data set are also examined. This combination of radiance modeling and statistical conditioning should yield reliable mesoscale soundings and provide a test bed for sounding research and development with the VAS instrument. Author

N81-19717# Naval Oceanography Command Center/Joint Typhoon Warning Center, Guam.
ANNUAL TROPICAL CYCLONE REPORT 1980 Annual Report, Jan. - Dec. 1980
1980 190 p refs
(AD-A094668) Avail: NTIS HC A09/MF A01 CSCL 04/2

Annual publication summarizing the tropical cyclone season in the western North Pacific, Bay of Bengal and Arabian Sea. A brief narrative is given on each significant tropical cyclone including the best track. All reconnaissance data used to construct the best tracks are provided. Forecast verification data and statistics

for the JTWC are summarized. Research efforts at the JTWC and NEPRF are discussed briefly. GRA

N81-19718# Transportation Systems Center, Cambridge, Mass.
ANALYSIS OF GROUND-WIND VORTEX SENSING SYSTEM DATA FROM O'HARE INTERNATIONAL AIRPORT Final Report, Jul. 1976 - Sep. 1977
T. E. Sullivan, J. N. Hallock, and B. P. Winston Sep. 1980 115 p refs
(AD-A095177; TSC-FAA-80-21; FAA-RD-80-133) Avail: NTIS HC A06/MF A01 CSCL 01/5

From July 1976 through September 1977, aircraft wake vortex data were collected on the approach to runways 14R, 27R, and 32L at O'Hare International Airport. The vortices from over 21,000 aircraft were tracked using the propeller anemometer Ground-Wind Vortex Sensing System (GWVSS) and the vortex behavior was correlated with the associated ambient meteorological conditions. The primary purpose of the tests was the evaluation of the Vortex Advisory System (VAS) concept. The elliptical wind criterion used in the VAS was verified using the vortex data. GRA

N81-19719# Army Engineer Topographic Labs., Fort Belvoir, Va. Military Graphic Information Data Processing and Products Div.
TERRAIN ANALYSIS PROCEDURAL GUIDE FOR CLIMATE
Roland J. Frodigh Sep. 1980 146 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A095158; ETL-0247) Avail: NTIS HC A07/MF A01 CSCL 15/4

This procedural guide provides the Army Terrain Analyst with the methods and procedures necessary to generate a thematic or factor overlay with supportive tables for portraying climate. Seven potential sources of information are considered: climatic summaries; climatic studies and climatic atlases; geographic studies and atlases; maps (climatic); technical literature; aerial photography; and maps (topographic). Procedures for extracting climatic information (data elements) from these sources are presented. Appendices provide the analysts with additional sources of information. GRA

N81-19720# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
EVALUATION OF THE ENVIRONMENTAL INSTRUMENTS INCORPORATED SERIES 200 DUAL COMPONENT WIND SET Research and Development Technical Report, May 1977 - Mar. 1978
W. J. Vechione Sep. 1980 49 p refs
(DA Proj. 1F2-63741-D-158)
(AD-A094828; ERADCOM/ASL-TR-0067) Avail: NTIS HC A03/MF A01 CSCL 04/2

Tests of atmospheric parameter measurements using the EII Series 200 Dual Component Wind Set with integral pressure and temperature sensors were made during the period of May 1977 through March 1978. These tests included laboratory comparison, wind tunnel, and field operation tests. Data collected with the sensor were compared to calibrated standards. Presented in this report are all tabulated and graphic representation as well as field operation results. The results of the test show the systems relative comparison with the calibrated standards of temperature and pressure. Wind measurements became more comparable with increasing windspeeds. A method of utilizing the entire windspeed capability range of the sensor is proposed. GRA

N81-19721# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
ONE-DIMENSIONAL CLOUD MICROPHYSICAL MODELS FOR CENTRAL EUROPE AND THEIR OPTICAL PROPERTIES Final Report
Richard D. H. Low Oct. 1980 42 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A094836; ERADCOM/ASL-TR-0070) Avail: NTIS HC A03/MF A01 CSCL 04/2

One dimensional microphysical models for six different cloud types are proposed. These models were formulated by making use of Khrgian-Mazin's one-parameter modified gamma distribution to judiciously mate the Russian measurements of cloud liquid water content and mean radius profiles to the German observations of various cloud types. With the drop-size spectra of the clouds thus determined as a function of height, calculation of their optical properties became straightforward. Separate regression relationships were established for the six model clouds, giving liquid water content and mean radius as a function of height above the cloudbase by the method of least-squares fit. It is from these relationships that the drop-size distribution may be derived for any level in a cloud of interest, and hence its spectral extinction coefficients at any wavelengths, in turn, from the distribution. A close examination of these coefficients in the visible and infrared window regions for each of the cloud types revealed that as a function of height they were well represented by polynomial relationships of 3 to 6 degrees. Regression coefficients for these relationships are presented in three separate tables. The six one dimensional model cloud types proposed herein may fill the gap which has long been felt in the modeling community and which is also found in our present electro-optical systems atmospheric effects library. GRA

N81-19722# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
AN EMPIRICAL MODEL OF THE VERTICAL STRUCTURE OF GERMAN FOGS Final Report
Louis D. Duncan, James D. Lindberg, and Radon B. Loveland Nov. 1980 36 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A094818; ERADCOM/ASL-TR-0071) Avail: NTIS HC A03/MF A01 CSCL 04/2

Data available from balloon-borne measurements of fog particle size distributions were analyzed to develop an empirical model of the vertical structure of German fogs. The data base consisted of approximately two dozen profiles collected at Grafenwohr and Meppen, Germany. Curve fitting procedures were applied to the results of liquid water content calculations and extinction coefficients calculations to develop single algorithms. Tables are included to show comparisons of the model outputs with the original data. GRA

N81-19723# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
GLOBAL TEMPERATURE PATTERNS 6000 YEARS AGO Progress Report
Thomas Webb, III Nov. 1980 61 p refs
(Contract DE-AC02-79EV-10097)
(DOE/EV-10097/2) Avail: NTIS HC A04/MF A01

Climatic patterns of the mid-Holocene (5000 to 7000 years B.C.) may be helpful in predicting some of the climatic changes during future climatic periods that are warmer than today. Research progress is reported on work done during the year to assemble data from pollen, marine plankton, and lake levels required for producing northern hemisphere climatic maps for the mid-Holocene. DOE

N81-19724# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
COMPARISON OF OBSERVED MIXED-LAYER DEPTHS TO MODEL ESTIMATES USING OBSERVED TEMPERATURES AND WINDS, AND MOS FORECASTS
A. J. Garrett 1980 3 p refs Presented at Am. Meteorol. Soc., 5th Symp. on Turbulence, Diffusion and Air Pollution, Atlanta, 9-13 Mar. 1981
(Contract DE-AC09-76SR-00001)
(DP-MS-80-69) Avail: NTIS HC A02/MF A01

Current operational atmospheric diffusion models use the concept of a well mixed layer in the lower atmosphere to limit upward diffusion of pollutants. In this research, two mixed layer prediction models were tested with selected days from the Wangara (Clarke, et al, 1971) and O'Neill (Lettau and Davidson, 1957) data sets. The models were also tested with one year (1978) of rawinsonde and surface data from four southeastern US stations. Mixed layer depths were predicted at the four stations using observed and forecast temperatures and winds. The forecast quantities were derived from the National Weather Service Limited area Fine Mesh (LFM) model and model output statistics. DOE

N81-19725# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

STUDY OF EFFECTS OF TOPOGRAPHY ON WIND ROSE STATISTICS

M. M. Pendergast 1980 3 p refs Presented at the 5th Symp. on Turbulence, Diffusion, and Air Pollution, Atlanta, 9-13 Mar. 1981

(Contract DE-AC09-76SR-00001)

(DP-MS-80-53; CONF-810306-3) Avail: NTIS HC A02/MF A01

A method to adapt wind rose data from one site to another making a quantitative adjustment for differences in topography is described. Meteorological towers within 200 km of the Savannah River Plant near Aiken, SC were used for the development and verification of the procedure. DOE

N81-19726# Stockholm Univ. (Sweden). Dept. of Meteorology.

ON THE DEPENDENCE OF ACCUMULATED PRECIPITATION ON THE CHARACTERISTICS OF SHOWERS

Ulla Hammarstrand Feb. 1980 71 p refs Prepared in cooperation with International Meteorological Inst.

(Contract G-2923-100)

(DM-29) Avail: NTIS HC A04/MF A01

A forecast model for the probability of precipitation in an area with convective activity was used to study the dependence of the accumulated amount of precipitation on radius, life time and intensity of the showers. The results indicate that the shower properties, even if essential, are of less importance than the large scale mean precipitation intensity in the convective area. Author (ESA)

N81-19727# Deutscher Wetterdienst, Offenbach am Main (West Germany).

AGROMETEOROLOGICAL INVESTIGATIONS ON EVAPORIMETERS AND THEIR PHYSICAL PROPERTIES

J. vonHoyningen-Huene 1980 28 p refs Sponsored by Deutsche Forschungsgemeinschaft Prepared in cooperation with Technische Univ., Brunswick and Hofuf Agricultural Research Centre, Saudi Arabia

(DW-148; ISBN-3-88148-168-0; ISSN-0072-4130) Avail: NTIS HC A03/MF A01

Data from wind tunnel tests and field tests in Germany and Saudi Arabia were used to determine the influence of meteorological parameters on evaporation from the U.S. Weather Bureau class A pan, and of the Czeratzki ceramic evaporation disk. Comparisons with the consumptive use of plants showed that the reactions of plants and instruments to air temperature are similar, whereas the reaction to wind velocity under dry conditions and to radiation is quite different. To compensate those differences, a quadratic correction formula was derived so the data from evaporimeters can be used for planning purposes, for irrigation control and as a tool for improving water use efficiency, i.e., as a basis for improving irrigation management both in arid and humid regions. Author (ESA)

N81-19728# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.

LIQUID SLOSHING UNDER LOW GRAVITY CONDITIONS: MATHEMATICAL MODEL AND BASIC NUMERICAL METHOD

A. E. P. Veldman 15 Jun. 1979 49 p refs

(Contract NIVR-1832)

(NLR-TR-79057-U) Avail: NTIS HC A03/MF A01

A mathematical model which describes the dynamic behavior of liquids in partially filled containers under low gravitational conditions is described. This model is used for the evaluation of a series of experiments to be performed onboard Spacelab. The unsteady Navier-Stokes equations are solved numerically by the Marker-And-Cell (MAC) technique. A fast elliptic solver which increases the speed of the MAC code by an order of magnitude is used. The method is confined to two dimensional flows where the free surface can be described by a single valued function of one of the coordinates. To treat arbitrary liquid configurations, a bookkeeping system must be introduced which defines the position of the free surface. Flow patterns inside a half full square container were calculated for various values of the contact angle and various excitations of the container. Examples with small amplitude liquid motion were compared with analytical results, and showed excellent agreement. Author (ESA)

N81-19729 Wisconsin Univ. - Madison. Space Science and Engineering Center.

STUDIES OF THE ATMOSPHERE USING AEROSPACE PROBES

Verner E. Suomi and David Suchman Jan. 1980 224 p refs

(Grant NOAA-04-6-158-44087)

(PB81-124380; NOAA-80100804; ISBN-0-299-97062-0) Copyright. Avail: NTIS HC A10/MF A01· CSCL 04B

Five papers are presented that deal with instruments and methods available for studies of the atmosphere using aerospace probes. The papers are: A False Stereographic Technique for Separation of Multiple Cloud Layers; Intracomparisons of SMS Wind Sets: A Study Using Rapid-Scan Imagery; On the Determination of Height Variations in Overshooting Thunderstorms from Geostationary Satellite Images; Global Winds, by Tracking Meteosat Water Vapor Patterns; and A Derived 850 Millibar Chart for the Western United States and Some Diagnostic Uses. GRA

N81-19730# National Weather Service, Salt Lake City, Utah. Western Region.

FREEZING LEVEL PROGRAM

Kenneth B. Mielke Sep. 1980 18 p refs

(PB81-128043; NOAA-NWS-WRCP-21; NOAA-80102205) Avail: NTIS HC A02/MF A01 CSCL 04B

This program computes the freezing level (MSL) for any station through the use of/or interpolation of actual data or by extracting the data from numerical model data. This is accomplished by only three input parameters, sea level pressure, 700 mb height and 500 mb height. Useful by-products of this program, especially when using the numerical progs, are the predicted 850 mb, 700 mb, and 500 mb temperatures. The program is completely integrated into AFOS; no procedure is needed to run the program. GRA

N81-19731# National Weather Service, Salt Lake City, Utah. Western Region.

HYDROLOGY PRACTICUM

Thomas Dietrich Sep. 1980 35 p

(PB81-134033; NOAA-TM-NWS-WR-158; NOAA-80102005) Avail: NTIS HC A03/MF A01 CSCL 04B

A short, but challenging, practice set of data is presented to help the meteorologist and meteorological technician better understand basic hydrology. The set of data was developed so that the user may be well prepared to issue flash flood warnings and watches. T.M.

N81-19732# National Oceanic and Atmospheric Administration, Princeton, N. J. Geophysical Fluid Dynamics Lab.

GEOPHYSICAL FLUID DYNAMICS LABORATORY (GFDL) ACTIVITIES-FY80, PLANS-FY81 WITH A REVIEW OF TWENTY-FIVE YEARS OF RESEARCH 1955-1980 Annual Report

1980 154 p refs

(PB81-132441; NOAA-80102401) Avail: NTIS HC A08/MF A01 CSCL 04B

The work accomplished at the Geophysical Fluid Dynamics Laboratory is summarized and a glimpse of the near future direction of its research plans is presented. A survey of twenty-five years of research at GFDL is included. GRA

N81-19733# National Oceanic and Atmospheric Administration, Rockville, Md. Atmospheric Programs Office.

SUMMARY OF WEATHER MODIFICATION ACTIVITIES REPORTED IN 1979

Mason T. Charak Jul. 1980 46 p ref

(PB81-126401; NOAA-80102004) Avail: NTIS HC A03/MF A01 CSCL 04B

Information is presented on the purposes, locations, sponsors, operators, equipment, techniques, target areas, seeding agents, seeding duration, operational procedures, and environmental factors associated with the activities. The data for 1979 are compared with the data reported for 1973-78, and some trends are noted. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-19734*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEANOGRAPHIC INFLUENCES ON THE SEA ICE COVER IN THE SEA OF OKHOTSK
Andrew J. Gratz (Princeton Univ., N. J.) and Claire L. Parkinson Feb. 1981 22 p refs
(NASA-TM-82085) Avail: NTIS HC A02/MF A01 CSCL 08L

Sea ice conditions in the Sea of Okhotsk, as determined by satellite images from the electrically scanning microwave radiometer on board Nimbus 5, were analyzed in conjunction with the known oceanography. In particular, the sea ice coverage was compared with the bottom bathymetry and the surface currents, water temperatures, and salinity. It is found that ice forms first in cold, shallow, low salinity waters. Once formed, the ice seems to drift in a direction approximating the Okhotsk-Kuril current system. Two basic patterns of ice edge positioning which persist for significant periods were identified as a rectangular structure and a wedge structure. Each of these is strongly correlated with the bathymetry of the region and with the known current system, suggesting that convective depth and ocean currents play an important role in determining ice patterns.
Author

N81-19735# Naval Ocean Systems Center, San Diego, Calif. Marine Sciences Div.
THE MESC PROGRAM FOR MARINE ENVIRONMENTAL QUALITY ASSESSMENT
Sep. 1980 7 p
(AD-A094700; NOSC/TD-383) Avail: NTIS HC A02/MF A01 CSCL 13/2

Federal and State regulatory agencies require the Navy to make environmental assessments whenever its activities might disturb existing estuarine ecosystems. These assessments are generally carried out by contractors prior to the preparation and filling of an environmental impact statement. Environmental Field Divisions (EFDs) and activities charged with awarding environmental contracts and overseeing environmental assessments are often faced with the need to obtain preliminary technical information. These data, which in general are of a physical, chemical, and biological nature, help define the spatial and temporal boundaries of the potential impact of new activities and are necessary before sound contractual agreements can be made. By its nature, this information must be readily available to the Officer-In-Charge and must be supported by expert consultants. GRA

N81-19736# Washington Univ., Seattle. Dept. of Atmosphere Sciences.
[PROPERTIES AND BEHAVIOR OF SEA ICE] Annual Report, 1 Oct. 1979 - 30 Sep. 1980
Seelye Martin and Gary Maykut 1 Dec. 1980 30 p
(Contract N00014-76-C-0234)
(AD-A095117; AR-12) Avail: NTIS HC A03/MF A01 CSCL 08/12

Research topics covered include (1) growth of ice in a wave field, (2) large scale heat exchange and ice production, (3) interaction of solar radiation with the ice and upper ocean, (4) optical properties of ice and snow, (5) generalized radiative transfer modeling, (6) wave propagation and other ice edge phenomena. GRA

N81-19737# Naval Research Lab., Washington, D. C.
THE NUMERICAL SOLUTION OF COUPLED NONLINEAR DIFFERENTIAL EQUATIONS OCCURRING IN OCEANOGRAPHIC THERMOSTAD MODELING Interim Report
Peter C. Mignerey 28 Jan. 1981 23 p refs
(AD-A094534; NRL-MR-4448) Avail: NTIS HC A02/MF A01 CSCL 21/1

A nonlinear numerical eigenvalue problem is solved to yield the shape and velocity profile of a submerged isothermal water mass assumed azimuthally symmetric and in gradient wind balance with a linearly stratified background. Solutions are found to exist and have widths approx. 30 km, heights approx. 100 m, and particle speeds at rim approx. 15 cm/sec. GRA

N81-19738# Coastal Engineering Research Center, Fort Belvoir, Va. Coastal Oceanography Branch.
INTERPRETATION OF WAVE ENERGY SPECTRA
Edward F. Thompson Jul. 1980 23 p refs
(AD-A089624; CERC-CETA-80-5) Avail: NTIS HC A02/MF A01 CSCL 08/3

Guidelines for interpreting nondirectional wave energy spectra are presented. A simple method is given for using the spectrum to estimate a significant height and period for each major wave train in most sea states. The method allows a more detailed and accurate description of ocean surface waves than that given by a single significant height and period, yet it eliminates much of the formidable detail of a full spectrum. An example problem illustrating application of the method is presented. Spectral analysis and display techniques and the natural variation of spectra in space and time are discussed. GRA

N81-19739# Naval Research Lab., Washington, D. C.
FORECAST OF REMOTE UNDERWATER SENSING TECHNOLOGY Final Report, May 1979 - Jul. 1980
Vicent A. Del Grosso and Perry B. Alers Jul. 1980 387 p refs
(MIPR-Z70099-9-94080)
(AD-A094686; USCG-D-38-80) Avail: NTIS HC A17/MF A01 CSCL 05/1

The main purposes of this report are: (1) the delineation of the current status of underwater remote sensing system technologies identified as having present or potential utility to current and projected U.S. Coast Guard missions; and (2) the development of 10 year and 25 year forecasts of the evolution of these technologies. A narrative discussion is presented in Chapter 4 of seven broad technological categories encompassing these systems, viz., ACOUSTIC, OPTICAL, MAGNETIC, ELECTRIC FIELD, ELECTROMAGNETIC (Miscellaneous), CHEMICAL, and FIBER OPTIC. These are further divided into 27 specific categories which are described in sufficient detail to permit familiarization with their individual promises and problems. GRA

N81-19740# Missouri Univ., Rolla. Dept. of Electrical Engineering.
ESTIMATION OF OCEANWAVE WAVENUMBER AND PROPAGATION DIRECTION FROM LIMITED SYNTHETIC APERTURE RADAR DATA Final Report, 1 Mar. 1979 - 31 Jan. 1981
Gordon E. Carlson, Craig L. Agne, and Charles M. McEniry Jan. 1981 192 p refs
(Contract N00014-75-C-0343; NR Proj. 387-102)
(AD-A095073; CSR-81-1) Avail: NTIS HC A09/MF A01 CSCL 17/9

A system for determining wavenumber and propagation direction for the dominant ocean wave component from a few scans of synthetic aperture radar data is described and analyzed. The analysis uses actual synthetic aperture radar data and provides system parameter tradeoffs and statistical performance results. While reasonable estimates of wavenumber and propagation direction are achieved in some cases, the estimates are not sufficiently consistent to be satisfactory over a wide range of cases. The primary problem is one of low signal-to-noise ratio of the radar scan data. GRA

N81-19741# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SINGLE AND DOUBLE REACTION BEAM LOAD CELLS FOR MEASURING ICE FORCES
P. R. Johnson and J. P. Zarling Oct. 1980 22 p refs
(AD-A094622; CRREL-80-25) Avail: NTIS HC A02/MF A01 CSCL 08/12

Two new types of load cells for attachment to bridge piers and direct measurement of ice forces were developed and tested with one type being installed on a pier of the Yukon River Bridge northwest of Fairbanks, Alaska. Both types of load cells used beams supported by base plates and carried nose plates that were loaded by the ice. The loads were imposed at the beams at locations differing from the support reactions so that

the loads developed moments in the beams. By instrumenting them with strain gauges, the loads could be measured. Details of the design of the load cells, the means of calculating the loads and experience obtained with load cells are discussed. GRA

N81-19742# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

MEASUREMENT OF THE SHEAR STRESS ON THE UNDERSIDE OF SIMULATED ICE COVERS

Darryl J. Calkins and Andreas Mueller Oct. 1980 19 p refs (AD-A094621; CRREL-80-24) Avail: NTIS HC A02/MF A01 CSCL 08/12

The fluid shear stress applied to the underside of a simulated floating ice cover was measured in a laboratory flume. The measured values were compared with values of the shear stress computed from the von Karman-Prandtl velocity distribution fitted to the velocity profiles measured beneath the cover. For the lower velocity runs (approx 0.079 m/s) the measured and computed values of the shear stress were in close agreement. At the high velocity flows (approx 0.137 m/s) the measured values were roughly one-half those calculated from the velocity distribution. As the underside of the cover became increasingly rougher, the position of maximum velocity moved closer to the bottom of the channel. It was shown that the Darcy friction coefficient is exponentially related to a normalized ice cover thickness, which suggests that it is a measure of the roughness of a fragmented ice cover. GRA

N81-19743# Army Cold Regions Research and Engineering Lab., Hanover, N. H. Snow and Ice Branch.

MODELING OF ANISOTROPIC ELECTROMAGNETIC REFLECTION FROM SEA ICE

Kenneth M. Golden and Stephen F. Ackley Oct. 1980 25 p refs

(Grant NSF DPP-77-24528)

(AD-A094620; CRREL-80-23) Avail: NTIS HC A02/MF A01 CSCL 08/12

The contribution of brine layers to observed reflective anisotropy of sea ice at 100 MHz is quantitatively assessed. The sea ice is considered to be a stratified, inhomogeneous, anisotropic dielectric consisting of pure ice containing ordered arrays of conducting inclusions (brine layers). Below the transition zone, the ice is assumed to have constant azimuthal c-axis orientation within the horizontal plane, so that the orientation of brine layers is uniform. The brine layers are also assumed to become increasingly well defined with depth, since adjacent brine inclusions tend to fuse together with increasing temperature. A theoretical explanation for observed reflective anisotropy is proposed in terms of anisotropic electric flux penetration into the brine layers. Penetration anisotropy and brine layer geometry are linked to anisotropy in the complex dielectric constant of sea ice. In order to illustrate the above effects, we present a numerical method of approximating the reflected power of a plane wave pulse incident on a slab of sea ice. GRA

N81-19744# Hawaii Univ., Honolulu. Dept. of Ocean Engineering.

CURRENT-WAVE SPECTRA COUPLING PROJECT. VOLUME 2: HURRICANE FIELDS AND CROSS SECTIONS, SURFACE WINDS AND CURRENTS, SIGNIFICANT WAVES AND WAVE SPECTRA FOR POTENTIAL OTEC SITES: (A) KEAHOLE POINT, HAWAII, 100 YEAR HURRICANE; (B) PUNTA TUNA, PUERTO RICO, 100 YEAR HURRICANE; (C) NEW ORLEANS, LOUISIANA, 100 YEAR HURRICANE; (D) WEST COAST OF FLORIDA, 100 YEAR HURRICANE; AND FOR (E) HURRICANE CAMILLE (1969) OFF LOUISIANA COAST. TECHNICAL SUPPORT FOR VOLUME 1

C. L. Bretschneider Jul. 1980 132 p 2 Vol.

(Contracts DE-AS03-76SF-00235; DE-AT03-76SF-20235)

(DOE/SF-20235/T1-Vol-2; Rept-80-1) Avail: NTIS HC A07/MF A01

This volume represents the details of the technical development of and the calibration of the two dimensional three parameter wave forecasting relationships, which are specially adapted for forecasting hurricane significant wave height, H/sub s/, modal wave period f0(-1) and the peak of the wave spectrum, S/sub max/. These three parameters lead to the determination of the three parameter wave spectrum which was verified by use of hurricane wind generated wave spectra from hurricane Eloise (1975). The hurricane wind field is still based on the original US Weather Service model. Hurricane winds, waves and wave spectra data from Hurricane Eloise (1975) were used. DOE

N81-19745# Hawaii Univ., Honolulu. Dept. of Ocean Engineering.

CURRENT-WAVE SPECTRA COUPLING PROJECT. VOLUME 1: HURRICANE FIELDS AND CROSS SECTIONS, SURFACE WINDS AND CURRENTS, SIGNIFICANT WAVES AND WAVE SPECTRA FOR POTENTIAL OTEC SITES: (A) KEAHOLE POINT, HAWAII, 100 YEAR HURRICANE; (B) PUNTA TUNA, PUERTO RICO, 100 YEAR HURRICANE; (C) NEW ORLEANS, LOUISIANA, 100 YEAR HURRICANE; (D) WEST COAST OF FLORIDA, 100 YEAR HURRICANE; AND FOR (E) HURRICANE CAMILLE (1969) OFF LOUISIANA COAST

C. L. Bretschneider Jun. 1980 114 p refs 2 Vol.

(Contracts DE-AM03-76SF-00235; DE-AT03-76SF-20225)

(DOE/SF-20235/T1-Vol-1; Rept-80-1) Avail: NTIS HC A06/MF A01

The 100 year hurricane criteria for the design of OTEC plants is included. The criteria, in addition to the maximum conditions of winds, waves and surface current, include: hurricane fields for wind speed U/sub s/ and significant wave height H/sub s/; hurricane fields for modal wave period f0(-1) and maximum energy density S/sub max/ of the wave spectrum; the corresponding Ekman wind driven surface current V/sub s/; and tabulated cross sections for U/sub s/, H/sub s/, f0(-1) and S/sub max/ through max U/sub s/ and through max H/sub s/ along traverses at right angles to and along traverses parallel to the forward movement of the hurricane. DOE

N81-19746# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data and Information Service.

A CLIMATOLOGIC AND OCEANOGRAPHIC ANALYSIS OF THE GEORGES BANK REGION OF THE OUTER CONTINENTAL SHELF Final Report

Fredric A. Godshall, Robert G. Williams, Joseph M. Bishop, Fred Everdale, and Steven W. Fehler Sep. 1980 302 p refs Sponsored in part by Bureau of Land Management, Washington, D.C.

(PB81-124919; NOAA-80100808) Avail: NTIS HC A14/MF A01 CSCL 08J

The results of an environmental study of the Georges Bank and Gulf of Maine Outer Continental Shelf areas are described. Study products include: (1) summaries of historical meteorological and oceanographic data from the study region; (2) interpretation and analysis of the summaries and a description of the marine environment; (3) conclusions, drawn from the analyses, that provide information concerning environmental processes and data limitations; and (4) recommendations for future analyses and for use of analytical procedures. GRA

N81-19747# Nova Univ., Dania, Fla.

SURFACE CURRENT: TRANSPORT CORRELATIONS IN THE FLORIDA CURRENT Final Technical Report

Irving Brooks 1980 29 p refs

(PB81-120844; NOAA-80101003) Avail: NTIS HC A03/MF A01 CSCL 08C

Dropsonde data from two sections in the Straits of Florida were examined in search of a correlation between surface current and total mass transport. The surface current distribution was subjected to: (1) cross stream integration with and without corrections due to wind effects, (2) cross stream integration including cross stream weighting functions, and (3) division of the transects into different regimes based on the position of the axis of the current. Under none of these conditions was a correlation found which was was both statistically reliable and physically reasonable. GRA

N81-19748# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

HF (HIGH FREQUENCY) RADAR MEASUREMENTS OF CIRCULATION IN THE EASTERN STRAIT OF JUAN DE FUCA (AUGUST, 1978) Final Report

Shelby Frisch and James Holbrook Apr. 1980 277 p refs

(PB81-127508; EPA-600/7-80-096) Avail: NTIS HC A13/MF A01 CSCL 08C

Surface currents in the eastern Strait of Juan de Fuca were mapped with a high frequency radar system. The surface currents were measured simultaneously over several hundred square kilometers at one hour intervals continuously for five days. Strong tidal currents, estuarine flow, and wind driven circulation were all identified as influential forces in the strait. These measurements were compared with those obtained with surface drifters and current meters, which were observed by the other participants in this experiment. The radar and current meter measured currents generally were in agreement to within a few centimeters per second. GRA

N81-19749*# Woods Hole Oceanographic Institution, Mass. Marine Policy and Ocean Management Program.

REMOTE SENSING IN THE COASTAL AND MARINE ENVIRONMENT. PROCEEDINGS OF THE US NORTH ATLANTIC REGIONAL WORKSHOP

James B. Zaitzeff, ed., Peter Cornillon, ed., and David A. Aubrey, ed. Oct. 1980 259 p refs Workshop held at West Greenwich, R.I., 30 May - 1 Jun. 1979 Prepared in cooperation with Rhode Island Univ., Kingston

(Contract NAS13-112)

(NASA-CR-164014; PB81-119315; WHOI-80-10; URI-P853) Avail: NTIS HC A12/MF A01 CSCL 01C

Presentations were grouped in the following categories: (1) a technical orientation of Earth resources remote sensing including data sources and processing; (2) a review of the present status of remote sensing technology applicable to the coastal and marine environment; (3) a description of data and information needs of selected coastal and marine activities; and (4) an outline of plans for marine monitoring systems for the east coast and a concept for an east coast remote sensing facility. Also discussed were user needs and remote sensing potentials in the areas of coastal processes and management, commercial and recreational fisheries, and marine physical processes. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-19750# California Univ., Irvine. Dept. of Community and Environmental Medicine.

DIRECT EXPOSURE OF MONOLAYERS OF MAMMALIAN CELLS TO AIRBORNE POLLUTANTS IN A UNIQUE CULTURE SYSTEM Annual Report

Ronald E. Rasmussen and T. Timothy Crocker 1 Feb. 1981 40 p refs

(Contract F49620-79-C-0082; AF Proj. 2312)

(AD-A094785; AFOSR-81-0093TR; HR-3) Avail: NTIS HC A03/MF A01 CSCL 06/6

The research was concerned with direct interaction between living mammalian cells and airborne pollutants. Mammalian cell lines were grown on cellulose ester membranes (Millipore) and exposed to test atmospheres in a specially designed system which maintained the cells in a viable state and in which pollutant concentrations were controlled and monitored. The specific tasks for this year have been to: (a) modify the exposure system to permit the use of organic vapors such as hydrazine and jet fuels; (b) measure the cytotoxic effects of mixtures of nitrogen dioxide and ozone as well as hydrazine and jet fuels on human and animal cell lines. Effects on cell proliferation and DNA synthesis would be included; (c) initiate studies to test the hypothesis that atmospheric oxidant gases such as NO2 or O3 may react with hydrocarbon vapors, such as jet fuels, to produce toxic or mutagenic products; and (d) evaluate two cell strains from adult rat lung tissues for use in the exposure system studies. The use of organic vapors in the exposure system has been facilitated by the employment of resistant materials such as stainless steel, Teflon, and silicone rubber as appropriate. GRA

N81-19751# Oak Ridge National Lab., Tenn.

CHEMICALS IDENTIFIED IN HUMAN BIOLOGICAL MEDIA, A DATA BASE Annual Report

M. V. Cone, comp., Margaret F. Baldauf, comp., Fay M. Martin, comp., and John T. Ensminger, comp. Jan. 1981 675 p refs Sponsored in part by National Cancer Inst.

(ORNL/EIS-163/V2-P2; AR-2) Avail: NTIS HC A99/MF A01

A comprehensive data base of chemicals identified in human biological media (tissues and body fluids) was established. The data base is contained in tabular format and arranged alphabetically by Chemical Abstracts Service (CAS) preferred chemical name. The chemical is given along with its CAS registry number, formula, atomic weight, melting point, boiling point, and vapor pressure. Tissues are listed alphabetically in with the record number. DOE

N81-19752# California Univ., Livermore. Lawrence Livermore Lab.

DESIGN AND FABRICATION OF A PORTABLE MINICUVETTE SYSTEM FOR MEASURING LEAF PHOTOSYNTHESIS AND STOMATAL CONDUCTANCE UNDER CONTROLLED CONDITIONS

G. E. Bingham, P. I. Coyne, R. B. Kennedy, and W. L. Jackson 14 Aug. 1980 66 p refs

(Contract W-7405-eng-48)

(UCRL-52895) Avail: NTIS HC A04/MF A01

The design specifications and some performance data for a miniaturized cuvette system suitable for measuring photosynthesis and stomatal conductance in the field are reported. The system operates on 12 V power (dc). An electronic support module is attached by an umbilical cord to a stirred reaction leaf chamber and a rechargeable battery pack. The chamber is heated or cooled by thermoelectric modules and humidity and CO2 concentration are kept steady by bleeding in dry air and CO2 enriched dry air through capillaries. Relative humidity is measured in situ by a fast response capacitive type humidity sensor. Carbon dioxide concentration is currently monitored by diverting exhaust gas from the chamber to a conventional infrared gas analyzer. A miniaturized, folded path infrared gas analyzer is to be incorporated into the system as an in situ CO2 sensor in a manner analogous to the humidity sensor. True CO2 can be estimated using (14)CO2 labeled air. The system features solid state pressure transducers for monitoring flow rate and digital readout for all parameters. DOE

N81-19753# Brookhaven National Lab., Upton, N. Y. Biology Dept.

CYCLES AND Q-CYCLES IN PLANT PHOTOSYNTHESIS

D. Crowther and Geoffrey Hind 1980 22 p refs Presented at the Conf. on Function of Quinones in Energy Conserving Systems, Hanover, N.H., 26-29 Oct. 1980

(Contract DE-AC02-76CH-00016)

(BNL-26884; CONF-8010149-1) Avail: NTIS HC A02/MF A01

The classical description of electron transfer in chloroplasts linked photosystem 2 to photosystem 1 with a simple hydrogen-carrying plastoquinone shuttle which transferred one H(+) per electron travelling through the chain. An additional H(+)/e(-) liberated inside the thylakoid with the splitting of water provided an overall H(+)/e(-) stoichiometry of 2. Cyclic electron transfer around photosystem 1 via cytochrome b563 was considered to reenter the main chain at plastoquinone, translocating one H(+) per electron completing the cycle. Such a scheme had to be modified, however, following the discovery of a further charge translocation that is observed, following a single turnover flash, as a slow rise in the electric field indicating bandshift termed P518. DOE

N81-19754# Florida State Univ., Tallahassee.

RADIATION INDUCED EFFECTS IN ORGANIC SYSTEMS Progress Report, 1 Dec. 1979 - 1 Dec. 1980

Russell H. Johnsen 1980 13 p refs

(Contracts DE-AS05-76ER-02001; EY-76-S-05-2001)

(DOE/EV-02001/1) Avail: NTIS HC A02/MF A01

The nature of the decay kinetics in systems yielding geminate radical pairs upon irradiation was investigated as well as OH reactions with aromatic hydrocarbons. Particular emphasis was placed on the p,p' azoxy phenetole molecule, studied at low temperatures using both polycrystalline and single crystal systems. The gas phase OH reactions were modified to produce reproducible results which can be interpreted as occurring in the bulk rather than as surface modified. The most surprising result was the

observation of relatively large amounts of biphenyl produced from benzene by OH radical attack. DOE

N81-19755# Brandeis Univ., Waltham, Mass.
EFFECTS OF LIGHT ON RESPIRATION AND DEVELOPMENT OF PHOTOSYNTHETIC CELLS Progress Report, 1 Mar. - 1 Nov. 1980
Martin Gibbs 20 Nov. 1980 15 p refs
(Contract DE-AC02-76ER-03231)
(DOE/ER-03231/5) Avail: NTIS HC A02/MF A01

The oxyhydrogen reaction in the presence and absence of CO2 was studied in H2 adapted Scenedesmus obliquus by monitoring the initial rates of H2, O2, and (14)CO2 uptake and the effect of inhibitors on these rates. Glucose and acetate respiration was competitive with H2 uptake. KCN inhibited equally respiration and the oxyhydrogen reaction in the presence and absence of CO2. It was concluded that the oxyhydrogen reaction both in the absence and presence of CO2 has properties in common with components of respiration and photosynthesis. Participation of these two processes in the oxyhydrogen reaction would require a closely linked shuttle between mitochondrion and chloroplast. Protoplasts and chloroplasts will be isolated from a H2 adapted alga in order to elucidate the cooperation between the two organelles. Acetate was shown to stimulate H2 photoproduction in H2 adapted algae even more so than an uncoupler of electron transport. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-19756# Royal Aircraft Establishment, Farnborough (England).
RELATIONSHIP BETWEEN STRESS DUE TO PHYSICAL ENVIRONMENTAL FACTORS AND HUMAN RELIABILITY
A. M. Metz and A. Meister Oct. 1980 17 p refs Transl. into ENGLISH from Z. Psychol. (Germany) vol. 184, no. 1, 1976 p 51-62
(RAE-LIB-Trans-2049; BR77344) Avail: NTIS HC A02/MF A01

Physical disturbance tests are used to demonstrate an application of the analysis of reliability with reference to experimental data. During 30 and 120 minute stressing by whole body exposure to vibrations of different frequency, acceleration, and type, subjects were required to muster all their powers of mental concentration (modified clock test of Mackworth and audible signal detection experiments). Data analysis of reliability of response proves to be a suitable means of describing performance. The following are the factors affecting reliability of performance: (1) condition of training of the subject; (2) time of activity; (3) time density of assignment; and (4) degree of stressing by exposure to vibrations. An attempt is made to correlate performance, physical disturbance, and central nervous system activation. S.F.

N81-19757*# National Aeronautics and Space Administration, Washington, D. C.
DEPENDENCE OF VESTIBULAR REACTIONS ON FREQUENCY OF ACTION OF SIGN-VARIABLE ACCELERATIONS
E. V. Lapayev, O. A. Vorob'yev, and V. V. Ivanov Oct. 1980 10 p refs Transl. into ENGLISH from Zh. Ushnykh Nosovykh Gorlovykh i Bolez. (USSR), no. 5, Sep. - Oct. 1979 p 333-337 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76410) Avail: NTIS HC A02/MF A01 CSCL 06P

It was revealed that during the tests with continuous action of sign variable Coriolis acceleration the development of kinetosis was proportionate to the time of head inclinations in the range of 1 to 4 seconds while illusions of rocking in sagittal plane was more expressed in fast inclinations. The obtained data provided the evidence of sufficient dependence of vestibulovegetative and vestibulosensory reactions on the period of repetition of sign variable Coriolis acceleration. Author

N81-19758*# National Aeronautics and Space Administration, Washington, D. C.
IDIOPATHIC ORTHOSTATIC HYPOTENSION: RECENT DATA (ELEVEN CASES) AND REVIEW OF THE LITERATURE
J. Ninet, G. Annat, D. Boisson, L. Holzhapfel, M. Vincent, L. Peyrin, D. Michel, B. Schott, M. Devic, and R. Levrat Feb. 1981 36 p Transl. into ENGLISH from Lyon Med. (France), v. 244, no. 13, 1980 p 11-24 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75890) Avail: NTIS HC A03/MF A01 CSCL 06P

Eight cases of Shy-Drager syndrome and three of Bradbury-Eggleston idiopathic orthostatic hypotension were examined. In all cases, examination of circulatory reflexes showed major dysfunction of the sympathetic vasoconstrictor system. Anomalies in the vagal cardiomoderator system were less constant. Normal urinary elimination of catecholamines was recorded daily. Characteristically, no elevation of blood or urine norepinephrine levels were found in orthostatism. Insulin hypoglycemia normally raised urinary adrenalin elimination in three of ten patients. Plasma dopa-beta-hydroxylase activity was normal. Renin-angiotensin-aldosterone system showed variable activity at basal state but usually rose during orthostatism. On the average, very low homovanillic acid levels were found in cerebrospinal fluid before and after probenecid; hydroxyindolacetic acid was normal. Cerebral autoregulation had deteriorated in two of four cases. Physiopathologically the two clinical types are indistinguishable with or without central neurological signs. M.G.

N81-19759# Enviro Control, Inc., Rockville, Md.
BIOLOGICAL EFFECTS OF SHORT, HIGH-LEVEL EXPOSURE TO GASES; CARBON MONOXIDE Phase Report, May 1979 - May 1980
Thomas E. Nightingale Jun. 1980 120 p refs
(Contract DAMD17-79-C-9086; DA Proj. 3E1-62777-A-846)
(AD-A094503) Avail: NTIS HC A06/MF A01 CSCL 06/20

This report presents an analysis and synthesis of the available literature describing health and performance effects of exposure to carbon monoxide (CO). The US Army's concern is with high-level, short-term exposures that may exceed present threshold limit values of the American Conference of Governmental Industrial Hygienists (50 ppm as a TWA and a ceiling of 400 ppm for 15 minutes). The organs primarily affected by exposure to CO are the heart and brain, with effects caused by impaired oxygen delivery. During brief exposures to concentrations of up to 35,600 ppm, there was an electrocardiographic change suggestive of myocardial ischemia within 15 seconds after the start of exposure, although there were no changes in heart rate, blood pressure or blood chemistry values in young healthy subjects. The first subjective sign of CO toxicity will probably be a headache followed by a awareness of a pounding heartbeat; however, the great variation in tolerance precludes establishment of threshold values per se, although a carboxyhemoglobin (COHb) of 15 percent would probably not elicit these symptoms in most healthy subjects. Laboratory studies have shown a reduction in work capacity following CO exposure in humans. The basis for this lower work capacity has been investigated in both humans and animal models, which is compensated for by an increase in coronary blood flow in healthy subjects up to 9% COHb in man and 30% COHb in dogs. GRA

N81-19760# Office of Naval Research, London (England).
CURRENT PERSPECTIVES IN HYPERBARIC PHYSIOLOGY, ULTRASONIC DOPPLER BUBBLE DETECTION, AND MASS SPECTROMETRY
B. G. DAoust (Virginia Mason Research Center, Seattle) 28 Dec. 1979 15 p
(AD-A082519; ORNL-R-5-79) Avail: NTIS HC A02/MF A01 CSCL 06/19

Two important analytical techniques in biomedical research have been increasingly utilized in hyperbaric physiology over the past 12 years. Doppler ultrasonic bubble detection on the one hand and mass spectrometry on the other have been used to demonstrate responses to both elevated pressure and decompression which have previously been only conjecture. Both techniques have raised controversies, yet both, properly used, are capable

not only of resolving them but also resolving many of the questions which have remained unanswered. The article discusses the 'state of the art' of these two techniques in hyperbaric medicine and some of the more promising areas for the future. GRA

N81-19761# Army Medical Research Inst. of Infectidus Diseases, Frederick, Md. Pathology Div.

THE ACTION OF BOTULINUM TOXIN AT THE NEUROMUSCULAR JUNCTION

Lawrence C. Sellin 22 Dec. 1980 36 p refs Submitted for publication

(AD-A094643) Avail: NTIS HC A03/MF A01 CSCL 06/5

Botulism results from the action of a protein neurotoxin (MW approx. 150,000) produced by the bacterium Clostridium botulinum, of which there are eight known strains. Botulinum neurotoxin is the most potent biological toxin known, having a median lethal dose of 5-50 ng/kg body weight. The primary site of action of botulinum toxin is the cholinergic nerve terminal, where it blocks the release of the neurotransmitter acetylcholine. Death usually results from respiratory failure. Nonlethal doses of botulinum toxin can induce sprouting of the nerve terminal and have significant postsynaptic effects, including muscle atrophy and alterations in the membrane electrical properties of the muscle fiber. There is no universally available treatment for botulinum intoxication. However, immunotherapeutic and chemotherapeutic procedures are now being developed and will be discussed. GRA

N81-19762# Naval Ocean Systems Center, San Diego, Calif.

REMOTE MEDICAL DIAGNOSIS SYSTEM (RMDS): EVALUATION OF THE AN/FTA-28 TELEPHONE TERMINAL INTERFACE Final Report, Apr. - Jul. 1978

W. T. Rasmussen, I. Stevens, and J. West (WESTEC Services) 1 Dec. 1980 21 p refs

(Contract N00123-77-D-0458)

(AD-A094831; NOSC/TR-631) Avail: NTIS HC A02/MF A01 CSCL 06/14

The mission of the Remote Medical Diagnosis System (RMDS) is to improve medical diagnosis at remote sites. This is accomplished by transmitting medical data and diagnostic information between remote ship or shore sites and full capability medical centers. The RMDS will enable the medical personnel at a remote site to contact a physician at a diagnostic center (ashore or shipboard) and transmit a visual and auditory presentation of the medical data needed for diagnosis, such as patient history, laboratory tests, ECG tracings, X-ray images, images of a patient injury, heart-lung sounds, and verbal descriptions. By return link, the physician will be able to send diagnosis and treatment information. The communication requirements for this are satisfied by any two way, voice grade, narrowband communication channel such as telephone line, HF or UHF radio, or satellite links. The system as a whole consists essentially of the Remote Medical Diagnosis Terminals (RMDTs), user personnel, and existing voice grade communication links which can be used to interconnect the terminals. All the hardware which is unique to the system is contained in the terminals, including a TV camera, TV monitor, X-ray light box, electronic stethoscope, ECG monitor, audio tape recorder, and audio handsets; and the electronics package, consisting of signal modulator, demodulator, and modems. Shipboard feasibility tests of an early RMDS were completed during FY 75/76. GRA

N81-19763# Oak Ridge National Lab., Tenn. Health and Environmental Studies Program.

CHEMICALS IDENTIFIED IN HUMAN BIOLOGICAL MEDIA, A DATA BASE Annual Report

M. Virginia Cone, comp., Margaret F. Baldauf, comp., Fay M. Martin, comp., and John T. Ensminger, comp. Jan. 1981 494 p refs Sponsored in part by National Cancer Inst.

(Contract W-7405-eng-36)

(ORNL/EIS-163/V2-P1; AR-2) Avail: NTIS HC A21/MF A01

A comprehensive data base of chemicals identified in human biological media (tissues and body fluids) was established. Data were primarily from the open literature through manual searches of the journals listed in Appendix A. The data base now contains information on over 500 different substances. Chemicals are listed by Chemical Abstracts Service (CAS) registry numbers and preferred names in Appendix B. For the user's convenience, cross-referenced chemical lists of CAS names are provided in Appendix C. The human tissues and body fluids found to be contaminated by these chemicals are listed in Appendix D. The data base is published annually in two parts. Part 1 contains introductory materials, references, appendices, indices, and a chemical directory. Information in Part 1 is cumulative, thus allowing the user access to information in the previous edition of Part 2. DOE

N81-19764# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A VISCOELASTIC FINITE ELEMENT MODEL OF THE HUMAN INTERVERTEBRAL JOINT M.S. Thesis

Ronald L. Hinrichsen Dec. 1980 107 p refs

(AD-A094774; AFIT/GAE/AA/80D-11) Avail: NTIS HC A06/MF A01 CSCL 06/16

The combined mechanical stresses on aircrewmen have become increasingly acute as technological developments extend the flight envelopes of our high performance aircraft. Limitations on the design of this type of aircraft are frequently dictated by human tolerance. The concept of an analytical model to evaluate the biomechanical response of the human intervertebral joint, under the influence of long term axial compressive loading, is important in assessing the load carrying capability of normal and diseased vertebral segments. It has been experimentally demonstrated that healthy intervertebral joints are composed of materials which exhibit creep characteristics. This investigation is significant because it presents a study of the time dependent behavior involved. An axisymmetric finitie element model is employed which incorporates a linear viscoelastic constitutive relation for the intervertebral disc. Viscoelastic material constants are found by matching one dimensional data with the two dimensional model. Results are presented depicting displacement profiles and stress redistributions occurring as a consequence of the inclusion of these viscoelastic parameters which, for the first time, simulate the actual human response to high compressive loads over a specific time span. GRA

N81-19765# California Univ., Berkeley. Lawrence Berkeley Lab. Biology and Medicine Div.

THEORETICAL AND OBSERVATIONAL ANALYSIS OF INDIVIDUAL IONIZING PARTICLE EFFECTS IN BIOLOGICAL TISSUE Ph.D. Thesis

Alan Carl Nelson Nov. 1980 166 p refs

(Contract W-7405-eng-48)

(LBL-11147) Avail: NTIS HC A08/MF A01

The microstructural damage to living tissue caused by heavy ion radiation was studied. Preliminary tests on rat corneal tissue, rat cerebellar tissue grown in culture, and rat retinal tissue indicated that the best assay for heavy ion damage is the rat cornea. The corneal tissue of the living rat was exposed to beams of carbon at 474 MeV/amu, neon at 8.5 MeV/amu, argon at 8.5 MeV/amu, silicon at 530 MeV/amu, iron at 500 MeV/amu, and iron at 600 MeV/amu. The X-rays were also used on corneas to compare with the heavy ion irradiated corneas. Scanning electron microscopy revealed lesions with circular symmetry on the external plasma membranes of corneal epithelium which were irradiated with heavy ions, but similar lesions were not observed on the plasma membranes of X-ray irradiated or nonirradiated control samples. These data verify the special way in which heavy ions interact with matter: each ion interacts coulombically with electrons all along its trajectory to generate a track. The dose from heavy ion radiation is not distributed homogeneously on a tissue microstructural scale but is concentrated along the individual particle track. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-19766# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

COMPUTER-BASED INTERACTIVE FLIGHT TRAINING Final Report, Apr. 1977 - Aug. 1980

Wallace Feurzeig, George Lukas, and Dan Stefanescu Nov. 1980 45 p refs

(Contract F49620-78-C-0066; AF Proj. 2313)
(AD-A094808; BBN-4530; AFOSR-81-0088TR) Avail: NTIS HC A03/MF A01 CSCL 05/9

Computer based methods were developed for describing the salient features of pilot performance on complex flight tasks. These methods extend and generalize a new approach to performance analysis expressly designed to mirror the procedures used by expert instructors in analyzing simulator flight data and diagnosing trainee errors. A data base for guiding the development of this instructor model of performance analysis was provided by a set of ILS approach tasks flown on the ORLY simulator. GRA

N81-19767# California Univ., Santa Barbara. Dept. of Psychology.
ON THE ESTIMATION OF MENTAL WORKLOAD Final Scientific Report
John W. Senders (Toronto Univ., Ontario) and Robert M Gottsdanker Nov. 1980 60 p refs
(Grant AF-AFOSR-0133-79; AF Proj. 2313)
(AD-A094783; AFOSR-81-0087TR) Avail: NTIS HC A04/MF A01 CSCL 05/8

The only practical way to attack the problems of mission delimitation, machine improvement, and operator specification in respect to mental workload appears to be computer simulations of both man and system performing a well-specified mission. As real systems afford the operator relative freedom of choice, the simulation of the human operator must possess intelligence. Unfortunately the data gathered in the laboratory on human performance are highly synthetic and concern the lowest elements of behavior. Uncritical use of these data to solve problems of mental workload cannot be justified. The utilization of methods of artificial intelligence to bear upon the intelligent restructuring of tasks appears feasible at the present time. It will probably suffice to include rational decision making and a capacity to solve certain classes of games. GRA

N81-19768# Letterman Army Inst. of Research, San Francisco, Calif. Div. of Biorheology.
CHROMATIC STROBE FLASH DISRUPTION OF PURSUIT TRACKING PERFORMANCE Final Report, Feb. - Apr. 1980
Peter A. OMara, David A. Stamper, David J. Lund, and Edwin S. Beatrice Nov. 1980 23 p refs
(DA Proj. 3M1-61102-BS-01)
(AD-A094911; LAIR-88) Avail: NTIS HC A02/MF A01

Ten men used a viscous damped mount optical tracking system during a study of the effects of strobe flashes and ambient lighting on pursuit tracking performance. The volunteers tracked a 0.5 mrad target moving to the left or right for 15 s at a constant angular velocity of 5.0 mrad/s. A single 170 micron 0.053 sr, 538 nm strobe flash was presented at random at the rate of one flash for each five trials. The flashes produced significant increases in the standard deviations of the horizontal and vertical aiming errors under both ambient light conditions. The average maximum aiming error was 0.6 mrad during bright ambient light trials. Approximately 2 s were required to return to normal control error rates. GRA

N81-19769# New Mexico State Univ., Las Cruces. Behavioral Engineering Lab.
GROUND-REFERENCED VISUAL ORIENTATION WITH IMAGING DISPLAYS Final Report, Oct. 1979 - Sep. 1980
Stanley N. Roscoe Nov. 1980 11 p refs
(Grant AF-AFOSR-0024-80; AF Proj. 2312)
(AD-A094662; BEL-80-3/AFOSR-80-3; AFOSR-81-0080TR) Avail: NTIS HC A02/MF A01 CSCL 05/10

Judgements of size, and by inference the distance, of objects in natural outdoor vistas are strongly dependent on the distance to which the eyes are focused (r approx 0.9); the exact functional relationship is confounded by the grossly progressive psychophysical inequality of units of the dioptric scale. Accommodation to natural vistas depends in a complicated way on the dark focus of the individual, the retinal locus and spatial frequency of visible texture, and the sharpness of focus needed for the desired discrimination of object identity, for example, reading a sign. Individual differences in dark focus range from perhaps 15 D in extremely myopic people to as distant as -4 D in the extremely hyperopic; the more distant the individual's dark focus, the greater the individual's tendency to focus beyond an acuity target to maximize apparent size for the discrimination of detail. Some individuals can be trained more readily than others to control the focal distance of their eyes voluntarily; there is some evidence that such trainability depends in part on the individual's dark focus and that both the selection and training of combat pilots should take such characteristics into account. GRA

N81-19770# Pittsburgh Univ., Pa. Learning Research and Development Center.
[PROCESSES OF INFORMAL REASONING AND RELATIONSHIPS BETWEEN INFORMAL AND FORMAL REASONING IN PROBLEM SOLVING] Final Report, 1 Oct. 1977 - 30 Sep. 1980
James G. Greeno 26 Jan. 1981 32 p refs
(Contract N00014-78-C-0022; RR04206)
(AD-A095138; TR-7) Avail: NTIS HC A03/MF A01 CSCL 05/10

Processes of informal reasoning and relationships between informal and formal reasoning in problem solving were examined. One set of studies focused on relationships between knowledge of problem solving procedures and knowledge of general conceptual relationships. The ways are specified in which problem solving performance can be influenced and problem solving procedures can be understood, because of their relationships to conceptual knowledge in the form of schemata. The second set of studies was concerned with relationships between general formal principles and cognitive procedures. Contributions included a method for formally analyzing relationships between procedures and constraints and a theoretical and empirical analysis of understanding the principle of formal deductive consequence in the context of geometry proof problems. E.D.K.

N81-19771# Naval Training Analysis and Evaluation Group, Orlando, Fla.
COMPUTER AIDED TRAINING EVALUATION AND SCHEDULING (CATES) SYSTEM ASSESSING FLIGHT TASK PROFICIENCY
William C. Rankin and William C. McDaniel Dec. 1980 28 p refs
(AD-A095007; TAEG-TR-94) Avail: NTIS HC A03/MF A01 CSCL 05/9

This report proposes a method for achieving improvements in the precision of determining Fleet Replacement Squadron student aviator proficiency. The proposed method is the Computer Aided Training Evaluation and Scheduling system. It provides a computer managed, prescriptive training program based on individual student performance. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-19772# School of Aerospace Medicine, Brooks AFB, Tex. Laser Effects Branch.
EVALUATION OF PLZT GOGGLES Final Report, Jun. 1978 - Apr. 1979
Everett O. Richey, James L. Bower, and Ralph G. Allen Dec. 1980 41 p refs
(AF Proj. 7757)
(AD-A094898; SAM-TR-80-17) Avail: NTIS HC A03/MF A01 CSCL 18/6

Air Force Prototype Thermal Flash Protective Device (TFPD) Goggles were furnished to USAFSAM by the Life Support System Program Office, Aeronautical Systems Division, for determination and evaluation of their eye-type goggles caused stressed areas. The bonding used in the production model eliminated the stressed areas, resulting in increased closed state optical density, particularly in the upper nasal area of the lens. GRA

N81-19773# California Univ., Berkeley. Lawrence Berkeley Lab. Passive Solar Group.

HUMAN COMFORT AND AUXILIARY CONTROL CONSIDERATIONS IN PASSIVE SOLAR STRUCTURES
W. Place, R. Kammerud, B. Anderson, B. Curtis, W. Carroll, C. Christensen, and M. Hannifan Oct. 1980 21 p refs Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-721-823) Avail: NTIS HC A02/MF A01

Energy consumption and human comfort implications of various passive solar and energy conservation strategies were investigated for single family, one story, slab on grade residences in Albuquerque, NM and Washington, DC. The building energy analysis computer program BLAST was used to perform annual dynamic heating and cooling load calculations for a building in which the glazing area, glazing location, and thermal mass were varied systematically. The impacts on building performance of forced flow ventilative cooling and nighttime and weekday thermostat setpoint adjustments were investigated. The results indicate that the annual heating and cooling loads are highly sensitive to glazing area, glazing location, and thermostatic controls. Annual cooling loads are substantially reduced by increased thermal mass in the walls. DOE

N81-19774# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.
ON THE STRUCTURE OF KNOWLEDGE. A MORPHOLOGY OF MENTAL MODELS IN A MAN-MACHINE SYSTEM CONTENT
Jean Rasmussen Nov. 1979 49 p refs
(RISOE-M-2192; ISBN-87-550-0618-3; ISSN-0418-6435) Avail: NTIS HC A03/MF A01

Forms of mental representations of the functional properties of a physical system as found in a man-machine system context are described and illustrated. A morphology of such models is discussed in terms of different levels of abstraction related to: physical form; physical function; functional structure; abstract function; and functional meaning or purpose. The distinction between deterministic quantitative models based on variables and relation and causal qualitative models based on objects or functions which have properties and interact by events is discussed. The dependency of the different levels of abstraction upon representation of aspects of the material basis of the system versus aspects of human reasons for the existence of the system is described. Finally, the different strategies of humans to cope with complexity is briefly discussed in the context of the morphology. Author (ESA)

N81-19775# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.
THE ROLE OF CONCEPTUAL STRUCTURES IN ANALYZING OPERATOR BEHAVIOR
Erik Hollnagel Feb. 1980 33 p refs
(RISOE-M-2217; ISBN-87-550-0521-7; ISSN-0418-6435) Avail: NTIS HC A03/MF A01

A consistent description and explanation of operator behavior must be based on the conceptual structures of the operator, his mental models and representation of knowledge, which can be inferred from an analysis of behavioral data. Three major problems in this analysis presented are: (1) the level or abstractness of the language used in the description of operator behavior, e.g., natural language versus a theoretically loaded terminology; (2) the degree of concreteness of the conceptual structure and the depth of explanation, i.e., the criteria by which the explanation is considered sufficient; and (3) the relation between competence and performance, in particular the role of performance criteria and the role of a demand resource fit. The relation between strategies and models and a description of the essential concepts in the conceptual structure are discussed. Author (ESA)

N81-19776# Man Factors, Inc., San Diego, Calif.
COMFORT AND CONVENIENCE SPECIFICATIONS FOR SAFETY BELTS: SHOULDER BELT FIT, PRESSURE AND PULLOUT FORCES Final Report, Oct. 1979 - Apr. 1980
W. E. Woodson, P. H. Selby, and R. Coburn 30 Apr. 1980 69 p refs
(Contract DOT-HS-7-01617)
(PB81-122152; MFI-78-109B(R); DOT-HS-805-597) Avail: NTIS HC A04/MF A01 CSCL 13L

The objective of the belt fit portion of the study was to determine how much an originally proposed shoulder belt crossing specification could be modified (to make it less restrictive on the vehicle designer) if a somewhat smaller segment of the user population was accepted as the criterion for design. As a result, a compliance envelope was developed and is proposed. The objective of the shoulder belt pressure portion of the study was to verify (or modify) the upper pressure criterion limit derived in the original study, using a larger sample of test subjects. The results essentially confirmed those of the original study. The purpose of the shoulder belt pullout force portion of the study was to develop a criterion value for inclusion in the comfort rulings if this appeared desirable. The value found proved to be essentially the same as one developed in an earlier study of active belt system comfort. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N81-19777*# Cyclomatic Industries, Inc., San Diego, Calif.
AEROSPACE GROUND EQUIPMENT FOR MODEL 4080 SEQUENCE PROGRAMMER. A STANDARD COMPUTER TERMINAL IS ADAPTED TO PROVIDE CONVENIENT OPERATOR TO DEVICE INTERFACE Final Project Report, Sep. 1977 - Jan. 1979
Lloyd E. Nissley Jan. 1979 20 p
(Contract NAS5-24304)
(NASA-CR-166633; FPR-603706) Avail: NTIS HC A02/MF A01 CSCL 09B

The Aerospace Ground Equipment (AGE) provides an interface between a human operator and a complete spaceborne sequence timing device with a memory storage program. The AGE provides a means for composing, editing, syntax checking, and storing timing device programs. The AGE is implemented with a standard Hewlett-Packard 2649A terminal system and a minimum of special hardware. The terminal's dual tape interface is used to store timing device programs and to read in special AGE operating system software. To compose a new program for the timing device the keyboard is used to fill in a form displayed on the screen. J.M.S.

N81-19778*# Alabama Univ. in Huntsville. Dept. of Computer Science.
HARDWARE SYNTHESIS FROM DDL DESCRIPTION Annual Technical Report, 1 Oct. 1979 - 30 Sep. 1980
Sajjan G. Shiva and Anil M. Shah Oct. 1980 181 p refs
(Contract NAS8-33096)
(NASA-CR-161667; ATR-2) Avail: NTIS HC A09/MF A01 CSCL 09B

The details of digital systems can be conveniently input into the design automation system by means of hardware description language (HDL). The computer aided design and test (CADAT) system at NASA MSFC is used for the LSI design. The digital design language (DDL) was selected as HDL for the CADAT System. DDL translator output can be used for the hardware implementation of the digital design. Problems of selecting the standard cells from the CADAT standard cell library to realize the logic implied by the DDL description of the system are addressed. Author

N81-19779# Washington Univ., Seattle. Dept. of Computer Science.
OPTIMAL PLACEMENT OF IDENTICAL RESOURCES IN A DISTRIBUTED NETWORK
Michael J. Fischer, Nancy D. Griffeth, Leo J. Guibas, and Nancy A. Lynch Jan. 1981 17 p refs Prepared in cooperation with Georgia Inst. of Tech., Atlanta
(Contracts N00014-80-C-0221; N00014-79-C-0873; DAAG29-79-C-0155)
(AD-A094786; TR-81-01-03) Avail: NTIS HC A02/MF A01 CSCL 09/2

The problem is considered of locating a number of identical resources at nodes of a tree so as to minimize the total expected cost of servicing a set of random requests for the resources. The cost of servicing a request is the tree distance from the requesting node to the node at which the resource satisfying the request is located. An algorithm for finding an optimal placement of resources is presented. GRA

N81-19780# Stanford Univ., Calif. Dept. of Computer Science.
THEORY OF COMPILER SPECIFICATION AND VERIFICATION Ph.D. Thesis
Wolfang Heinz Polak May 1980 155 p
(Contract MDA903-76-C-0026; Grant NSF MCS-76-00321)
(AD-A094604) Avail: NTIS HC A08/MF A01 CSCL 09/2

The formal specification, design, implementation, and verification of a compiler for a PASCAL-like language is described. All components of the compilation process such as scanning, parsing, type checking, and code generation are considered. The implemented language contains most control structures of PASCAL, recursive procedures and functions, and jumps. It provides user defined data types including arrays, records, and pointers. A simple facility for input-output is provided. The target language assumes a stack machine including a display mechanism to handle procedure and function calls. The compiler itself is written in PASCAL Plus, a dialect of PASCAL accepted by the Stanford verifier. The Stanford verifier is used to give a complete formal machine checked verification of the compiler. One of the main problem areas considered is the formal mathematical treatment of programming languages and compilers suitable as input for automated program verification systems. Several technical and methodological problems of mechanically verifying large software systems are considered. Some new verification techniques are developed, notably methods to reason about pointers, fixed points, and quantification. These techniques are of general importance and are not limited to compiler verification. The result of this research demonstrates that construction of large correct programs is possible with the existing verification technology. It indicates that verification will become a useful software engineering tool in the future. Several problem areas of current verification systems are pointed out and areas for future research are outlined. GRA

N81-19781# Naval Training Equipment Center, Orlando, Fla.
FRONT-END ANALYSIS: GENERIC AND NONGENERIC MODELS Final Report, Jun. 1979 - Aug. 1980
B. E. Mulligan (Univ. of Georgia, Athens) and J. F. Funero Sep. 1980 47 p refs
(AD-A095106; NAVTRAEQUIPC-IH-325) Avail: NTIS HC A05/MF A01 CSCL 09/2

Front end analysis is described as an iterative process by means of which the requirements of a system may be made progressively more definitive. The importance of information to the process - whether it is obtained through an empirical study or from a generic data base - is stressed. The degree of detail with which system requirements may be specified depends on the level of information available at the time they are formulated. As specificity of system requirements increase, there may be a corresponding advance in the state of the system. The analysis process may be degraded by time-cost constraints, etc., the primary result being a reduction in the amount and quality of information needed by the analyst to determine system requirements and alternative action plans at adequate levels of specificity. It is agreed that this degrading effect of constraints may be minimized by an information procurement and management system that would make available to the analyst generic data. A number of models for front end analysis that take advantage of generic data bases are presented within the context of training systems. Each is evaluated in terms of the gain in specificity of training requirements and instructional regimens that it may achieve relative to nongeneric analyses carried out under constrained and constraint-free conditions. GRA

N81-19782# Los Alamos Scientific Lab., N. Mex.
DOE RESEARCH IN UTILIZATION OF HIGH PERFORMANCE COMPUTERS
B. L. Buzbee, W. J. Worlton, G. Michael (Calif. Univ., Lawrence Livermore Lab.), and G. Rodrigue (Calif. Univ., Lawrence Livermore Lab.) Dec. 1980 15 p refs
(Contract W-7405-eng-36)
(LA-8609-MS) Avail: NTIS HC A02/MF A01

A brief description of high performance computers is given. The use of and future needs for high performance computers within DOE is addressed. The growing complexity of applications within DOE and areas of high performance computer systems warranting research are also discussed. E.D.K.

N81-19783# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
A GROUND STATION WITH USER INTERACTIVE OPERATION SOFTWARE FOR MAGNETOMETER EXPERIMENTS [EINE BODENSTATION FUER MAGNETOMETEREXPERIMENTE MIT BEDIENUNGSFREUNDLICHER SOFTWARE]
W. Ramsauer and R. Schmidt (Oesterreichischen Akademie der Wissenschaften) 1979 5 p In GERMAN
Avail: NTIS HC A02/MF A01

A processing unit, test device which simulates the functions of an onboard magnetometer data processing and control system was developed. The software behind remote data acquisition onboard Spacelab as well as for video display and user interactive control on the ground is outlined. The processor tester is based on wire wrap technology. Hardware, including a microprocessor, the video interface, the remote acquisition unit interface, the digital to analog converter, and the analog to digital converter, is described. Author (ESA)

N81-19784# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
A COMPUTER CONTROLLED MAGNETOMETER ON BOARD SPACELAB 1 [EIN PROZESSORGESTEUERTES MAGNETOMETER AN BORD VON SPACELAB 1]
E. Ofner, R. Schmidt (Oesterreichischen Akademie der Wissenschaften), and N. Valavanglou 1979 5 p In GERMAN
Avail: NTIS HC A02/MF A01

A microprocessor controlled magnetometer which determines magnetic field vectors by measuring the X, Y and Z components based on the Foerster probe principle was developed. The magnetometer electronics are described, emphasizing the analog to digital converter and the CMOS-microprocessor CPU design. Data acquisition, data preprocessing and data transfer are considered step by step. Circuitry related data value errors are discussed and the complementary nature of the magnetometer experiment to a low energy electron flux density experiment is mentioned. Author (ESA)

N81-19785# Graz Univ. (Austria). Inst. fuer Nachrictentechnik und Wellenausbreitung.
EXPERIMENT AUTONOMOUS DATA PREPROCESSING ON BOARD INTERPLANETARY SPACE PROBES [EXPERIMENTINTERNE DATENVORVERARBEITUNG AN BORD INTERPLANETARER RAUMSONDEN]
R. Schmidt (Oestereichischen Akademie der Wissenschaften) and K. Schwingenschuh 1979 5 p refs In GERMAN
Avail: NTIS HC A02/MF A01

A diagram of the data reduction circuitry controlling a space probe magnetometer and associated simulation software are presented. The probe measures the dynamic structure of interplanetary magnetic fields and is able to adjust autonomously to varying measurement conditions. Scanner and telemetry layout are based on previous data from MARINER 10. Magnetic field intensity data are stored in a magnetic bubble memory for transmission to Earth. Comparison of a 1 min continuous measurement mean with a 1 sec mean idnetifies significant measurement direction. Data reduction before transmission is by digital filtering and a fast Fourier transformation. Author (ESA)

N81-19786# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.
COMPUTER'S CONTRIBUTION TO RESEARCH LABORATORIES. COMPUTERS IN EXPERIMENT DESIGN. THE MODEL'S REDEFINITION [APPORTS DE L'INFORMATIQUE AUX LABORATOIRES D'ESSAIS. L'INFORMATIQUE DANS LA PREPARATION ET L'EXPLOITATION DES ESSAIS. LE 'RECALAGE' DES MODELES]
Leriche 6 Mar. 1980 4 p In FRENCH Presented at 7th ASTE Journees Sci. et Tech., Paris, 18-20 Mar., 1980
(SNIAS-801-422-106) Avail: NTIS HC A02/MF A01

The relationship between computer utilization and experimental activities is discussed using the example of the tests performed on the Ariane dynamic model. The test objectives are listed, including the primary goal of verifying the mathematical models. It is concluded that the preliminary computation work is an efficient way of optimizing experimental programs. Author (ESA)

N81-19787# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
AN INTRODUCTION TO MULTIPROCESSOR SCHEDULING
J. K. Lenstra Apr. 1980 21 p refs Submitted for publication
(Grant NATO-9.2.02(SRG.7))
(MC-BW-121/80) Avail: NTIS HC A02/MF A01

A brief description of the theory of the computational complexity of combinatorial problems and a survey of results in the area of multiprocessor scheduling are presented. A number of basic models for scheduling jobs on parallel machines are presented. The special case of unit processing times and the influence of precedence constraints between the jobs is considered, as well as the case in which preemption (job splitting) is allowed and varying job release dates may be specified. The development of polynomial optimization algorithms, the application of the concept of NP hardness, and the analysis of approximation algorithms are discussed. Author (ESA)

N81-19788# Federal Compiler Testing Center, Washington, D.C. Automated Data and Telecommunication Service.
HEWLETT PACKARD COMPANY HP-3000 SERIES 3 COBOL 2/3000, RELEASE 32233A.00.02 Validation Summary Report
8 Sep. 1980 75 p refs
(PB81-125072; CCVS74-VSR610) Avail: NTIS
HC A04/MF A01 CSCL 09B

The validation report of the HP 3000 Series 2 and 3 COBOL Compiler Version 32233A.00.02 (MPE/3000 Version B.01.02) is presented. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-19789 Houston Univ., Tex.
CHARACTERIZATION OF MANIPULATOR GEOMETRY Ph.D. Thesis
Alok Kumar 1980 221 p
Avail: Univ. Microfilms Order No. 8101061

Two problems involving mechanical manipulators are presented: the positioning errors of the hand of a manipulator and the workspaces associated with a manipulator. Two statistical models, one based on normally distributed joint servo errors, and the other based on uniformly distributed joint servo errors, are presented to estimate the positioning error of the hand. The surfaces within which the manipulator hand achieves a specified level of positioning accuracy with a given probability are plotted. Another method, which is more attractive computationally to plot the surfaces of positioning accuracy is also developed. An algorithm is presented to plot the surfaces which bound the different workspaces associated with a manipulator. A scheme is developed to label these surfaces and to identify the surface which bounds the reachable workspace. If a dextrous workspace does exist for a manipulator, it is bounded by one of the surfaces generated by the algorithm. Dissert. Abstr.

N81-19790# Mathematisch Centrum, Amsterdam (Netherlands).
LINDENMAYER SYSTEMS: STRUCTURE, LANGUAGES, AND GROWTH FUNCTIONS
P. M. B. Vitanyi 1980 214 p refs
(Math-Centre-Tracts-96) Avail: NTIS HC A10/MF A01

Aspects of mathematical models of the processes of biological development are discussed. These models are called L systems, which are strings of rewriting systems where each letter of each string symbolizes the presence in that position of a cell of a certain type or state and the whole of each string symbolizes a filament of cells. Time is assumed to be discrete and, in between two consecutive moments of time, say between t and t+1, each letter of a string is rewritten as a string which may be empty. This rewriting may depend on the m left and n right neighbors of the letter concerned. The resultant string at time t+1 consists of the concatenation of the strings resulting from the rewriting of the individual letters. By repeating this process, a sequence of strings are obtained symbolizing the developmental history of the modeled filamentous organism. It is shown that various embellishments, with or without biological interpretation, of this basic model can be contrived. R.C.T.

N81-19791# Mathematisch Centrum, Amsterdam (Netherlands).
REDUCTION METHODS IN NONLINEAR PROGRAMMING
G. VanDerHoek 1980 140 p refs
(Math-Centre-Tracts-126) Avail: NTIS HC A07/MF A01

Methods which solve problems by reducing an optimization problem into one or more simpler problems by decreasing the degree of nonlinearity of the problem functions and/or by decreasing the number of constraints are considered. Topics covered include (1) computational comparison of self scaling variable metric algorithms; (2) recursive quadratic programming with self scaling update of the second order information; asymptotic properties of reduction methods using linearly equality constrained reduced problems; (3) convergence of sequences of Kuhn-Tucker points; (4) algorithmic and numerical aspects of 2 phase reduction methods; (5) Cholesky factorization; and (6) computational comparison of 2 phase algorithms and recursive quadratic programming algorithms. Constrained and unconstrained nonlinear test problems and special matrices are also examined. A.R.H.

N81-19792*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
STUDY OF ADAPTIVE METHODS FOR DATA COMPRESSION OF SCANNER DATA
Mar. 1977 153 p refs
(Contract NAS2-8394)
(NASA-CR-152007; TRW-26566) Avail: NTIS
HC A07/MF A01 CSCL 09B

The performance of adaptive image compression techniques and the applicability of a variety of techniques to the various steps in the data dissemination process are examined in depth. It is concluded that the bandwidth of imagery generated by scanners can be reduced without introducing significant degradation such that the data can be transmitted over an S-band channel. This corresponds to a compression ratio equivalent to 1.84 bits per pixel. It is also shown that this can be achieved using at least two fairly simple techniques with weight-power requirements well within the constraints of the LANDSAT-D satellite. These are the adaptive 2D DPCM and adaptive hybrid techniques.M.G.

N81-19793*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
USER'S MANUAL FOR SYNC: A FORTRAN PROGRAM

FOR MERGING AND TIME-SYNCHRONIZING DATA
Richard E. Maine Mar. 1981 26 p refs
(NASA-TM-81355) Avail: NTIS HC A03/MF A01 CSCL 09B

The FORTRAN 77 computer program SYNC for merging and time synchronizing data is described. The program SYNC reads one or more input files which contain either synchronous data frames or time-tagged data points, which can be compressed. The program decompresses and time synchronizes the data, correcting for any channel time skews. Interpolation and hold last value synchronization algorithms are available. The output from SYNC is a file of time synchronized data frames at any requested sample rate. E.A.K.

N81-19794*# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
NUMERICAL ALGORITHMS FOR FINITE ELEMENT COMPUTATIONS ON ARRAYS OF MICROPROCESSORS Semiannual Report, 1 Sep. 1980 - 28 Feb. 1981
J. M. Ortega Mar. 1981 14 p
(Contract NAG1-46)
(NASA-CR-164008; UVA/528190/AMCS81/101; SAR-2) Avail: NTIS HC A02/MF A01 CSCL 09B

The development of a multicolored successive over relaxation (SOR) program for the finite element machine is discussed. The multicolored SOR method uses a generalization of the classical Red/Black grid point ordering for the SOR method. These multicolored orderings have the advantage of allowing the SOR method to be implemented as a Jacobi method, which is ideal for arrays of processors, but still enjoy the greater rate of convergence of the SOR method. The program solves a general second order self adjoint elliptic problem on a square region with Dirichlet boundary conditions, discretized by quadratic elements on triangular regions. For this general problem and discretization, six colors are necessary for the multicolored method to operate efficiently. The specific problem that was solved using the six color program was Poisson's equation; for Poisson's equation, three colors are necessary but six may be used. In general, the number of colors needed is a function of the differential equation, the region and boundary conditions, and the particular finite element used for the discretization. M.G.

N81-19795# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
CHECKING WHETHER PROGRAMS ARE CORRECT OR INCORRECT
R. J. R. Back Sep. 1980 40 p refs
(MC-IW-144/80) Avail: NTIS HC A03/MF A01

A program is considered as consisting of two parts, an algorithm and a specification, where the latter records the programmer's intentions as to how the algorithm should work. The question of what is a proper notion of semantic correctness for such programs is discussed. For a suitable notion of semantic correctness, a system to check it for programs is described. This system either declares a program to be semantically correct, or it shows it to be incorrect by exhibiting a semantic error.
Author (ESA)

N81-19796# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
EVALUATION OF NATURAL LANGUAGE PROCESSORS Ph.D. Thesis
Harry Ralph Tennant Nov. 1980 257 p refs
(Contract N00014-75-C-0812)
(AD-A094762; T-103) Avail: NTIS HC A12/MF A01 CSCL 05/2

This thesis attempts to clarify some of the difficulties behind evaluating the performance of natural language processors. It also proposes an evaluation method that is designed to be systematic and thorough. The method relies on considering a natural language processor from three viewpoints in the light of several taxonomies of issues relevant to natural language processing. Finally, an evaluation is described of PLANES, a natural language database query system. GRA

N81-19797# Harvard Univ., Cambridge, Mass. Computation Lab.
DISTRIBUTED ALGORITHMS FOR SYNCHRONIZING INTERPROCESS COMMUNICATION WITHIN REAL TIME
John H. Reif and Paul Spirakis 1980 26 p refs
(Contract N00014-80-C-0647; Grant NSF MCS-79-21024)
(AD-A094650; TR-23-80) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper considers a fixed (possibly infinite) set, pi, of distributed asynchronous processes which at various times are willing to communicate with each other. Probabilistic algorithms for synchronizing this communication with boolean 'flag' variables, each of which can be written by only one process and read by at most one other process are described. With very few assumptions, synchronization algorithms were shown to have real time response: if at any time a pair of processes are mutually willing to communicate, they establish communication within a constant time interval with high likelihood (for the worst case behavior of the system). The communication model and synchronization algorithms are quite robust and can be applied to solve a large class of resource synchronization problems, as well as implement Dijkstra's CSP in real time. GRA

N81-19798# Texas Univ. at Austin. Center for Cybernetic Studies.
EFFECTIVE SOLUTION OF NON-CONVEX MULTI-OBJECTIVE RATIO GOALS PROBLEMS
R. Armstrong, A. Charnes, W. W. Cooper, and C. Haksever Dec. 1980 13 p refs
(Contracts N00014-80-C-0242; N00014-75-C-0569)
(AD-A095026; CCS-390) Avail: NTIS HC A02/MF A01 CSCL 12/2

Multiple ratio goals often occur in equity considerations and imply non-linear non-convex programming problems. Charnes' and Cooper's solution of such a class by a sequence of linear programs is herein implemented by an effective computational method applicable to a larger class of non-linear non-convex problems. An analytical prescription of the recursion to preserve feasibility of the last basic solution is derived. A new usage of the fast re-inversion routine of current LP codes to obtain the modified basis inverse is developed together with the further subroutines of the Opposite Sign Algorithm of Charnes and Kortanek (1963) or a negative image scheme whenever the old basic solution is not basic feasible for the modified problem. An illustration in terms of funding of State colleges in Texas is provided. GRA

N81-19799# Naval Postgraduate School, Monterey, Calif.
NUMERICAL OPTIMIZATION USING DESKTOP COMPUTERS M.S. Thesis
Walter Bacon Cole Sep. 1980 165 p refs
(AD-A095012) Avail: NTIS HC A08/MF A01 CSCL 09/2

Two computer programs were developed in advanced BASIC to perform numerical optimization of a user supplied design problem on the Hewlett Packard 9845A desktop computer. An executive program, OPCON, provides the interactive link between the computer user and the DESOP numerical optimization program. DESOP performs the numerical optimization using the sequential unconstrained minimization technique with an external penalty function. The unconstrained subproblem is solved using the Fletcher-Reeves method of conjugate directions and using Golden Section search and polynomial interpolation in the one dimensional search. A computer subprogram, NISCO, was developed in advanced BASIC to model a nonimaging concentrating compound parabolic trough solar collector. Thermophysical, geophysical, optical and economic analyses were used to compute a life cycle fuel savings for a design of stated thermal capacity. NISCO was coupled to the OPCON/DESOP optimization program to find the design which maximizes the life cycle fuel savings. GRA

N81-19800# Naval Postgraduate School, Monterey, Calif.
ATHENA: USERS MANUAL FOR INTERACTIVE ANALYSIS OF LARGE-SCALE OPTIMIZATION MODELS
Gordon H. Bradley, Gerald G. Brown, and Panagiotis I. Galatas Apr. 1980 55 p refs
(AD-A095020; NPS52-80-008) Avail: NTIS HC A04/MF A01 CSCL 09/2

Analyses of solutions for large-scale optimization models are very difficult without effective computer aids. Solution reports may require weeks to design, implement and produce with conventional report writing systems. ATHENA has been developed to allow extremely efficient immediate interactive storage and

analysis of the solution file from any optimization system. ATHENA is easy to learn and use; user friendly features are provided which can preemptively assess the potential cost and implications of each request for solution information, assist the confused user, and provide the required solution information with very fast response time. The user is provided with extensive search under mask and compound logical relational constructs, as well as the capability to quickly diagnose suspicious model symptoms, and to format and issue offline reports. ATHENA is implemented in portable FORTRAN, with a parser and interpreter easily modified and expanded to suit particular hardware environments and user demands. The system has been initially designed and tuned for large-scale problems with up to 30,000 rows and columns. Live test demonstrations show that the system exhibits very fast response time in actual use. This report presents a users manual for the prototype ATHENA query language, an error message directory, and a description of interface and extension provisions. GRA

N81-19801# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.

CAMAC MODULAR PROGRAMMABLE FUNCTION GENERATOR

G. W. Turner, S. Suehiro, and R. W. Hendricks Dec. 1980 42 p refs Sponsored in part by NSF

(Contract W-7405-eng-26)

(ORNL/TM-7363) Avail: NTIS HC A03/MF A01

A CAMAC modular programmable function generator was developed. The device contains a 1024 word by 12 bit memory, a 12 bit digital to analog converter with a 600 ns settling time, an 18 bit programmable frequency register, and two programmable trigger output registers. The tripper registers can produce programmed output logic transitions of various (binary) points in the output function curve, and are used to synchronize various other data acquisition devices with the function curve. DOE

N81-19802# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

INTERNATIONAL SOLAR POLAR MISSION. A REAL-TIME DATA SIMULATOR

R. Terenzi Mar. 1980 79 p refs

(LPS-80-3) Avail: NTIS HC A05/MF A01

A user's guide and a description of an instrument built for real time simulation of magnetic field data are presented. The instrument allows a complete test of the onboard despinning and shock computer for the magnetometer designed for the International Solar Polar Mission spacecraft. The simulator interface with the digital part of the experiment which simulates the output of the two A/D converters is described. An Intel 8020 microcomputer was used. Author (ESA)

N81-19803# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

ON THE POWER OF REAL-TIME TURING MACHINES UNDER VARYING SPECIFICATIONS

Paul M. B. Vitanyi Mar. 1980 17 p refs Presented at 7th Intern. Colloq. on Automata, Languages and Programming, Noordwijkerhout, Netherlands, 14-18 Jul. 1980 Submitted for publication

(MC-IW-132/80) Avail: NTIS HC A02/MF A01

The relative computing power of Turing machines with differences in the number of work tapes, heads per work tape and instruction repertoire is investigated. The k-tape, k-head and k-head jump models as well as the two way multihead finite automata with and without jumps are studied. Differences in computing power between machines of unlike specifications emerge under the real time restriction. In particular, it is shown that k + 1 heads are more powerful than k heads for real time Turing machines. Author (ESA)

N81-19804# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

DERIVING ALGORITHMS BY ADDING AND REMOVING VARIABLES

H. B. M. Jonkers Apr. 1980 50 p refs Submitted for publication

(MC-IW-134/80) Avail: NTIS HC A03/MF A01

A simple method of deriving algorithms and showing the correctness of the derivation is described. It is based on decomposing global transformations amounting to changes of representation into a number of local transformations, the correctness of which is self evident. The effectiveness of the method is demonstrated in a derivation and proof of correctness of the Deutsh-Schorr-Waite marking algorithm. Author (ESA)

N81-19805# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

SEMANTICS OF UNBOUNDED NONDETERMINISM

R. J. R. Back Apr. 1980 17 p refs Submitted for publication

(MC-IW-135/80) Avail: NTIS HC A02/MF A01

A program construct is proposed, for which the assumption of bounded nondeterminism is not natural. It is shown that the simple approach of taking the power domain of the flat cpo does not produce a correct semantics for programs in which nondeterminism is unbounded. The power domain approach is then extended to computation paths, resulting in an essentially operational semantics for programs of unbounded nondeterminism. Author (ESA)

N81-19806# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

RELATIVIZED OBLIVIOUSNESS

P. M. B. Vitanyi May 1980 11 p refs Presented at 8th Symp. on Math. Found. of Computer Sci., Rydzyna-Zamek, Poland, 31 Aug. - 6 Sep. 1980 Submitted for publication

(MC-IW-137/80) Avail: NTIS HC A02/MF A01

Relativized obliviousness is introduced to capture the intuitive idea, that some problems allow fastest computations which are more oblivious than do other problems, without any of such computations being oblivious in the standard sense. It is shown that each increase in the obliviousness of an algorithm for the solution of some problems, may necessarily require an increase in computation time from T(n) steps to T(n) log T(n) steps. There is, however, no problem for which a total oblivious algorithm requires more than order T(n) log T(n) steps, if the best algorithm for it runs in T(n) steps. On-line Turing machines are used as model of computation. Author (ESA)

N81-19807# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

TWO-TAPE REAL-TIME COMPUTATION

Paul M. B. Vitanyi Jul. 1980 36 p refs Submitted for publication

(MC-IW-139/80) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

The problem of whether two heads on a single tape is a more powerful storage device than two single head tapes for real time Turing machines is examined. It is shown that under the condition that a certain weak conjecture is true, a two head tape unit is more powerful than two single head tapes, and that for the one way and two way storage-retrieval units, precisely three tapes are necessary and sufficient for real time simulation by a multitape Turing machine. Author (ESA)

N81-19808# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

AN ALGOL 60 PACKAGE FOR THE SOLUTION OF NONLINEAR EQUATIONS

J. C. P. Bus Aug. 1980 63 p refs

(MC-NW-88/80) Avail: NTIS HC A04/MF A01

A user manual for an ALGOL 60 software package is presented. This package contains procedures for solving systems of nonlinear equations using Newton-like methods. These allow triangular decomposition, singular decomposition and explicit scaling. Conditional updating is allowed in restrained difference methods. The functions involved in these equations are assumed to be differentiable. The software package is based on the NUMAL software library. Author (ESA)

N81-19809# National Bureau of Standards, Washington, D.C. Inst. of Computer Sciences and Technology.

NBS SOFTWARE TOOLS DATABASE

Raymond C. Houghton, Jr. and Karen A. Oakley Oct. 1980 108 p refs

(PB81-124935; NBSIR-80-2159) Avail: NTIS

HC A06/MF A01 CSCL 09B

A listing of information on the software tools contained in the NBS Software Tools Database is provided. The data was placed into a relational database using PASCAL. The database allows for information retrieval on tool features, languages, developers, documentation, hardware and software requirements, availability, publications, and contacts. GRA

N81-19810# Federal Compiler Testing Center, Washington, D.C.
INTERNATIONAL BUSINESS MACHINES CORPORATION. IBM SERIES/1 COBOL 5719-CB1, VERSION 1, LEVEL 2, REALTIME PROGRAMMING SYSTEM (RPS), VERSION 4
Sep. 1980 45 p
(PB81-118820; CCVS74-VSR690) Avail: NTIS HC A03/MF A01 CSCL 09B

The Validation Summary Report (VSR) for the IBM Series 1 COBOL Compiler Version 1.2 (RPS Version 4.1) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the Low-Intermediate level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N81-19811# Federal Compiler Testing Center, Washington, D.C.
DTSS INCORPORATED DTSS COBOL
3 Nov. 1980 43 p
(PB81-118689; CCVS74-VSR635) Avail: NTIS HC A03/MF A01 CSCL 09B

The validation of the DTSS Incorporated COBOL Computer Version 07 is reported. The categories of discrepancies found are related to each of the Federal levels of the language and a detailed listing of discrepancies and the tests which were failed is given. GRA

N81-19812# Federal Compiler Testing Center, Washington, D.C.
FOUR-PHASE SYSTEMS FOUR-PHASE IV/90 MODEL 2 MFE/IV RELEASE BN03 COBOL '74 RELEASE BE03
3 Nov. 1980 41 p
(PB81-118671; CCVS74-VSR710) Avail: NTIS HC A03/MF A01 CSCL 09B

The validation of the Four Phase Systems COBOL Computer Version BE03 (MPE/IV Version BN03) against the 1974 COBOL Standard is summarized. An overview of the validation which lists all categories of discrepancies by level/module is given and discrepancies are related to each of the Federal levels of the language. A detailed listing of discrepancies together with the tests which were failed is also given. GRA

N81-19813# SRI International Corp., Menlo Park, Calif.
THE SRI HIERARCHICAL DEVELOPMENT METHODOLOGY (HDM) AND ITS APPLICATION TO THE DEVELOPMENT OF SECURE SOFTWARE
Karl N. Levitt, Peter G. Neumann, and Lawrence Robinson Oct. 1980 59 p refs
(Contract NBS-5-35932)
(PB81-115537; NBS-SP-500-67; LC-80-600157) Avail: NTIS HC A04/MF A01 CSCL 09B

The hierarchical development methodology (HDM) is described which employs a staged decomposition of the development process, separating design, data representation, and implementation. For any given system development, HDM employs a hierarchical decomposition of the design and formal specifications of modules and their interconnections. Extensive tools are used throughout the development to check the appropriateness of the design and its implementation. The role of HDM in developing secure systems is considered and various efforts using HDM to develop such systems are summarized. The use of the methodology is illustrated by examples. GRA

N81-19814# National Weather Service, Salt Lake City, Utah. Scientific Service Div.
CONTIGUOUS FILE TRANSFER FROM THE DPCM TO THE DCM
Paul D. Tolleson Sep. 1980 14 p refs
(PB81-128035; NOAA-NWS-WRCP-20; NOAA-80102204) Avail: NTIS HC A02/MF A01 CSCL 09B

The package of utility programs that allows the user to transfer a contiguous file from the DPCM computer to the DCM computer through the MCA, provided the file exists on both sides, is described. GRA

N81-19815# Transportation Systems Center, Cambridge, Mass. Structures and Mechanics Branch.
CARPLT, SEMLOG, LOGPLT (GENERAL PURPOSE INTERACTIVE CARTESIAN, SEMI-LOG, AND LOG-LOG PLOTTING PROGRAMS) USER'S/PROGRAMMERS MANUAL
Roman Czerepica Nov. 1980 49 p
(PB81-128373; DOT/DF-81/001A) Avail: NTIS HC A03/MF A01 CSCL 09B

Carplt, Semlog, and Logplt, the three modules making up General Purpose Interactive Plotting Programs are described. The program is designed by the working data analyst to enable him to simply and rapidly generate report quality cartesian, semilog, and log-log data plots. Each module can uniquely plot 12 sets of data on a single graph with each data set consisting of u to 100 data points. Various plotting and labeling options are incorporated. However, no special knowledge is required to use the program, since all program required information is obtained through interactive requests that essentially amount to yes/no responses on the part of the user. GRA

N81-19816# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
NBS MINIMAL BASIC TEST PROGRAMS. VERSION 2, USER'S MANUAL. VOLUME 1: DOCUMENTATION Final Report
John V. Cugini, Joan S. Bowden, and Mark W. Skall Nov. 1980 82 p refs
(PB81-128407; NBS-SP-500-70/1; NBS/DF-81/003A; LC-80-600163) Avail: NTIS HC A05/MF A01 CSCL 09B

The set of programs developed for the purpose of testing conformance of implementations of the computer language BASIC to the American National Standard for Minimal Basic, ANSI X3.60-1978 is described. By submitting the programs to a candidate implementation, the user can test the various features which an implementation must support in order to conform to the standard. While some programs can determine whether or not a given feature is correctly implemented, others produce output which the user must then interpret to some degree. How the programs should be used so as to interpret correctly the results of the tests is described. GRA

N81-19817# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
NBS MINIMAL BASIC TEST PROGRAMS. VERSION 2, USER'S MANUAL. VOLUME 2: SOURCE LISTINGS AND SAMPLE OUTPUT Final Report
John V. Cugini, Joan S. Bowden, and Mark W. Skall Nov. 1980 491 p
(PB81-128415; NBS/DF-81/003B; NBS-SP-500-70/2) Avail: NTIS HC A21/MF A01 CSCL 09B

The rationale underlying the design of the version 2 minimal BASIC test programs is discussed and detailed instructions for interpreting the tests are given. Information is presented which allows the user to examine the source code in its original form as well as get an idea of what the output from a standard conforming implementation should look like. All the features for which implementations may differ are also presented. R.C.T.

62 COMPUTER SYSTEMS

Includes computer networks.

N81-19818# Brookhaven National Lab., Upton, N. Y. Dept. of Applied Mathematics.
MODEL FOR THE COMPUTER-AIDED-DESIGN OF LOCAL COMPUTER NETWORKS
A. M. Peskin and K. Yuen Jul. 1980 16 p *refs* Presented at the 5th Berkeley Workshop on Distributed Data Management

and Computer Networks, Berkeley, Calif., 3 Feb. 1981
(Contract DE-AC02-76CH-00016)
(BNL-28175; CONF-810202-1) Avail: NTIS HC A02/MF A01

The computer aided design of local computer networks is discussed with particular reference to 'back-end' networks. The back-end network is characterized by block oriented traffic, data rates in the multimegabit range, and functional roles featuring direct access to very large mass storages and interconnection of data base processors. To the extent that data set or file access has a direct effect on processing speed, a properly performing back-end network can provide considerable throughput improvement to a computing installation. DOE

N81-19819# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Automatic Control.
CHOICE OF REGULATOR FOR MUTUAL NETWORK SYNCHRONIZATION
Aleksander Marlevi 1979 18 p refs
(TRITA-REG-7904) Avail: NTIS HC A02/MF A01

Time-discrete regulators used for clock synchronization of mutual single-ended digital networks are compared. The stability, engineering, and implementation of proportional (P), proportional and integrating (PI), and proportional with double integration (PII) regulators are studied. It is shown that neither the P nor the PI regulators are slip free, while the PII regulator achieves phase stability and slip-free operation. The implementation of the PII regulator in a microprocessor is shown to be feasible, and engineering design diagrams are presented. Author (ESA)

N81-19820# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Automatic Control.
REGULATOR DESIGN FOR MUTUAL NETWORK SYNCHRONIZATION
Aleksander Marlevi 1979 46 p refs
(TRITA-REG-7905) Avail: NTIS HC A03/MF A01

Design parameters for regulators used in clock synchronization of single ended digital networks are analyzed. The sampling interval, the elastic buffer size and three regulator gains are studied. Results for a two-level hierarchical network show a five-fold decrease in the time constant. It is shown that while the proportional and integrating regulator gains are equal for almost all network sizes, the double integrating gain decreases sharply with increasing network size. The sampling interval should be as short as possible, but not shorter than the transmission delay between the controlled nodes. The elastic buffer size was roughly estimated. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N81-19821 Houston Univ., Tex.
ANALYSIS AND SYNTHESIS OF MULTIVARIABLE CONTROL SYSTEMS Ph.D. Thesis
Ardeshir Tajvari 1980 139 p
Avail: Univ. Microfilms Order No. 8103743

An array from the coefficients of the transfer function was constructed. The elements of this array were used to construct a new transformation matrix which transforms the state equation in the canonical form to the state equation in the tridiagonal form. Some applications of the array and the tridiagonal system matrix including stability, Sturm series and state space realization of transfer functions were developed. For multivariable systems a block array was developed and the minimal realization of the matrix transfer function was investigated. From the elements of the block array, a matrix Sturm series was constructed which allowed the Cauchy index to be applied to determine the number of real eigenvalues of the system. A stability criterion from the elements of the new block array and the block tridiagonal system matrix for certain class of multivariable systems was developed. A state space approach was formulated for the realization of the matrix transfer functions by using RC ladder networks and operational amplifiers. Dissert. Abstr.,

N81-19822*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
PRELIMINARY DEMONSTRATION OF A ROBUST CONTROLLER DESIGN METHOD Final Report, 15 Jun. - 15 Nov. 1980
L. R. Anderson 15 Nov. 1980 145 p refs
(Contract NAG1-80)
(NASA-CR-164010; VPI-AERO-120) Avail: NTIS HC A07/MF A01 CSCL 09B

Alternative computational procedures for obtaining a feedback control law which yields a control signal based on measurable quantitites are evaluated. The three methods evaluated are: (1) the standard linear quadratic regulator design model; (2) minimization of the norm of the feedback matrix, k via nonlinear programming subject to the constraint that the closed loop eigenvalues be in a specified domain in the complex plane; and (3) maximize the angles between the closed loop eigenvectors in combination with minimizing the norm of K also via the constrained nonlinear programming. The third or robust design method was chosen to yield a closed loop system whose eigenvalues are insensitive to small changes in the A and B matrices. The relationship between orthogonality of closed loop eigenvectors and the sensitivity of closed loop eigenvalues is described. Computer programs are described. M.G.

N81-19823# Honeywell Systems and Research Center, Minneapolis, Minn.
ADVANCED PATTERN-MATCHING TECHNIQUES FOR AUTONOMOUS ACQUISITION Quarterly Progress Report, 4 Feb. - 23 Jul. 1980
P. M. Narendra and B. L. Westover Oct. 1980 40 p
(Contract DAAK70-79-C-0114)
(AD-A094630; DOC-80SRC76; QPR-3) Avail: NTIS HC A03/MF A01 CSCL 07/5

The key objective of this effort is the development of pattern-matching algorithms which can impart autonomous acquisition capability to precision-guided munitions such as Copperhead and Hellfire. Autonomous acquisition through pattern matching holds the promise of eliminating laser designation and enhancing fire power by multiple target prioritization. The pattern-matching approach being developed under this program is based on a symbolic pattern-matching framework, which is suited for the autonomous acquisition scenario. It is based on matching a symbolic representation dérived from the two images, and it can accommodate the stringent pattern-matching criteria established by the scenario: enormous differences in the scene perspective, aspect and range between the two sensors, differences in sensor characteristics and illumination, and scene changes such as target motion and obscuration from one view point to the other. GRA

N81-19824# California Univ., Berkeley. Electronics Research Lab.
PROPOSAL FOR CONFIGURATION CONTROL FOR THE ARPA STANDARD VERSION OF THE UNIX OPERATING SYSTEM
R. S. Fabry 1980 4 p
(Contract N00039-80-K-0649; ARPA Order 4031)
(AD-A094691) Avail: NTIS HC A02/MF A01 CSCL 09/2

The ARPA Standard Version of the UNIX Operating System ('the System') shall consist of the original Western Electric Version 7 UNIX software and documentation as modified and enhanced by the Contractor according to this agreement. GRA

N81-19825# *Engins Matra, Velizy (France).*
PATTERN RECOGNITION AND ARTIFICIAL INTELLIGENCE. PARALLELEPIPED CLASSIFICATION BY MAHALANOBIS METRICS AND LEARNING BY HISTOGRAMS [CLASSIFICATION PARALLELIPIPEDIQUE PAR METRIQUE DE MAHALONOBIS ET APPRENTISSAGE SUR HISTOGRAMME]
Gabriel E. Lowitz 1979 8 p refs In FRENCH Presented at Reconnaissance des Formes et Intelligence Artificielle, Toulouse, Sep. 1979
(V-57) Avail: NTIS HC A02/MF A01

A pattern recognition strategy is proposed. The method starts with an histogram analysis from which a first estimation of the class averages and variances is obtained. A study of those classes

permits to obtain a classical supervised classification. The Mahalanobis method was utilized; a point is attributed to one class based on the information contribution to that class if the point really belongs to that class. The classification method is optimum in the sense of information extraction, given 8 to 16 classes for 512 x 512 pixel images. The method is very fast, and verification tests give acceptable results. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-19826 Houston Univ., Tex.
ON THE ALGEBRA OF AXODE SURFACES IN KINEMATICS Ph.D. Thesis
Rajpal Singh Sodhi 1980 142 p
Avail: Univ. Microfilms Order No. 8103742

The concepts of fixed and moving axode surfaces which duplicate the motion of a spatial mechanism are expected to play an important fundamental role in three dimensional kinematics. The relationship between the axodes and the geometric configuration of spatial mechanisms was studied. It was determined that the order of the axodes of the 4R spherical mechanism were 16. In addition, the algebraic equations for the axodes of the 4R spherical mechanism were determined in terms of the mechanism geometry. Since the axodes of the spatial linkage were algebraic surfaces, the properties of planar algebraic geometry were extended to three dimensions. The analogs between the characteristics of the algebraic surfaces and algebraic curves were investigated. The axode surfaces for three different spatial mechanisms were generated and represented graphically to aid in visualization. Dissert. Abstr.

N81-19827 Washington Univ., St. Louis, Mo.
LOCAL A POSTERIORI INDICATORS OF ERROR FOR THE P-VERSION OF THE FINITE ELEMENT METHOD Ph.D. Thesis
David Alan Dunavant 1980 131 p
Avail: Univ. Microfilms Order No. 8103707

Local error indicators in energy norm are developed for one and two dimensional problems in elasticity. The indicators are proportional to the error contribution of individual finite elements. This property of the indicators provides a basis for obtaining optimal or nearly optimal distributions of polynomial degrees of basis functions over a finite element mesh. Examples are presented. Dissert. Abstr.

N81-19828# Mathematisch Centrum, Amsterdam (Netherlands).
VARIABLE DIMENSION FIXED POINT ALGORITHMS AND TRIANGULATIONS
A. J. J. Talman and Gerard VanDerLaan 1980 177 p refs
(Math-Centre-Tracts-128) Avail: NTIS HC A09/MF A01

Fixed point theorems are widely used in existence proofs of solutions to nonlinear problems. Numerous applications include the existence of an equilibrium strategy vector in noncooperative N-person games, the existence of a price equilibrium in economic models, and the existence of a solution to (un)constrainted optimization problems and nonlinear complementarity problems. A measure for the efficiency of a triangulation of a convex subset is introduced and a variable dimension algorithm was developed to compute a fixed point of a continuous function from the product space of unit simplices into itself. T.M.

N81-19829# Mathematisch Centrum, Amsterdam (Netherlands).
CENSORING AND STOCHASTIC INTEGRALS
R. D. Gill 1980 182 p refs
(Math-Centre-Tracts-124) Avail: NTIS HC A09/MF A01

The application of probability theory to the statistics of censored data is considered with attention given to the interrelations between stochastic integrals, martingales, counting processes, and weak convergence of processes. Right censored observations and stochastic integrals are considered for two cases, one of which discusses the product limit estimator. Asymptotic results, efficiencies and new test statistics are examined as well as general censorship and truncation. Theorem proving is included. A.R.H.

N81-19830# Mathematisch Centrum, Amsterdam (Netherlands).
THE 2-D SYSTEMS: AN ALGEBRAIC APPROACH Ph.D. Thesis - Eindhoven Univ. of Technology
R. Eising 1980 146 p refs
(Math-Centre-Tracts-125; ISBN-80-6196-198-X) Avail: NTIS HC A07/MF A01

An algebraic approach to the digital processing of two dimensional sampled data is examined in detail. An introduction and some results in the theory of systems over rings are given and some differences with the theory of systems over a field are pointed out. Realization algorithms are developed for systems over a principal ideal domain. These algorithms are related to some of the existing alogorithms for systems over a field. Also some applications to delay differential systems and systems over the integers are given. It is shown that 2D systems can be seen as 1D systems over a principal ideal domain. Some state space models and local state space models are developed. Also some causality concepts are introduced and it is shown that these are closely related to recursiveness of the defining equations of the local state space models under consideration. Furthermore, it is shown that the existing models are special cases of the developed models. Various properties and refinement procedures of the 2D state space models are discussed. Finally, the realization algorithms are modified in such a way that the specific structure of 2D systems can be exploited. M.G.

N81-19831# Mathematisch Centrum, Amsterdam (Netherlands).
SIMPLICIAL FIXED POINT ALGORITHMS
Gerard VanDerLaan and A. J. J. Talman 1980 177 p refs
(Math-Centre-Tracts-129) Avail: NTIS HC A09/MF A01

Many problems in economics, nonlinear programming and other fields can be solved by using fixed point algorithms, which should be regarded as one of the major breakthroughs in computational methods for nonlinear problems. Algorithms to compute a fixed point are presented and the conditions to guarantee the convergence of the algorithms on unbounded regions are stated. Important fixed point theorems were reviewed. Some applications of the equilibrium price vector in economic models and the solution of an unconstrained optimization problem are presented. T.M.

N81-19832# Mathematisch Centrum, Amsterdam (Netherlands).
NUMERICAL SOLUTION OF SYSTEMS OF NONLINEAR EQUATIONS Ph.D. Thesis
J. C. P. Bus 1980 272 p refs
(Math-Center-Tracts-122; ISBN-90-6196-195-5) Avail: NTIS HC A12/MF A01

The problem of the analysis and design of methods for the iterative or algebraic solution of nonlinear equations is addressed with attention given to the existence and uniqueness of solutions obtained by Newton-like methods. These local methods require an initial estimate of the solution which is relatively close to an extract solution. A comprehensive convergence theory is presented in which the notion of affine invariance plays an important role. Two poly algorithms (combinations of Newton-like algorithms) are presented. ALGOL 68 was used as a reference language. A.R.H.

N81-19833*# Stanford Univ., Calif. Inst. for Plasma Physics.
EXAMINATION OF TIME SERIES THROUGH RANDOMLY BROKEN WINDOWS
P. A. Sturrock Nov. 1980 21 p refs Sponsored in part by Max C. Fleischmann Foundation
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-164043; SU-SUIPR-824) Avail: NTIS HC A02/MF A01 CSCL 12A

The effect of irregular interruption of data collection (the breaking of the window function) on the spectrum determination of a time series is investigated. It is assumed that there is a uniform probability p that each interval of length tau, of the total interval of length T = tau, yields no data. For the linear case (Fourier transform) it is found that the noise to signal ratio has a (one sigma) value less than epsilon if N exceeds p(-1) (1-p) epsilon (-2). For the quadratic case, the same requirement is met by the less restrictive requirement that N exceed p(-1)

(1-p) epsilon (-1). It appears that, if four observatories spaced around the Earth were to operate for 25 days, each for six hours a day (N = 100), and if the probability of cloud cover at any site on any day is 20% (p = 0.8), the r.m.s. noise to signal ratio is 0.25% for frequencies displaced from a sharp strong signal by 15 micro Hz. The noise to signal ratio drops off rapidly if the frequency offset exceeds 15 micro Hz. M.G.

N81-19834*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NUMERICAL APPROXIMATION OF BOUNDARY CONDITIONS WITH APPLICATIONS TO INVISCID EQUATIONS OF GAS DYNAMICS

H. C. Yee Mar. 1981 87 p refs

(NASA-TM-81265; A-8480) Avail: NTIS HC A05/MF A01 CSCL 20D

A comprehensive overview of the state of the art of well-posedness and stability analysis of difference approximations for initial boundary value problems of the hyperbolic type is presented. The applicability of recent theoretical development to practical calculations for nonlinear gas dynamics is examined. The one dimensional inviscid gas dynamics equations in conservation law form are selected for numerical experiments. The class of implicit schemes developed from linear multistep methods in ordinary differential equations is chosen and the use of linear extrapolation as an explicit or implicit boundary scheme is emphasized. Specification of boundary data in the primitive variables and computation in terms of the conservative variables in the interior is discussed. Some numerical examples for the quasi-one-dimensional nozzle are given. Author

N81-19835# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

MODAL DECOMPOSITION OF COVARIANCE SEQUENCES FOR PARAMETRIC SPECTRUM ANALYSIS

Louis L. Scharf, A. A. Beex (Virginia Polytechnic Inst. and State Univ.), and Timothy vonReyn Mar. 1981 10 p refs Presented at the Intern. Conf. on Acoustics, Speech, and Signal Process., Atlanta, 30 Mar. 1981

(Contracts N00014-75-C-0518; DAAG29-78-C-0176)

(AD-A095099; TR-37) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper we make the point that a wide variety of spectrum types admit to modal analysis wherein the modes are characterized by amplitudes, frequencies, and damping factors. The associated modal decomposition is appropriate for both continuous and discrete components of the spectrum. The domain of attraction for the decomposition includes ARMA sequences, harmonically or nonharmonically related sinusoids, damped sinusoids, white noise, and linear combinations of these. Numerical results are presented to illustrate the identification of mode parameters and corresponding spectra from finite records of perfect and estimated covariance sequences. The results for sinusoids and sinusoids in white noise are interpreted in terms of in phase and quadrature effects attributable to the finite record length. GRA

N81-19836# North Carolina Univ. at Chapel Hill.

A PERSPECTIVE AND PROPOSAL FOR THE INITIAL TRANSIENT PROBLEM IN SIMULATION

George S. Fishman Dec. 1980 27 p Proposed for presentation at the ORSA/TIMS Meeting, Toronto, Ontario, 4-6 May 1981

(Contract N00014-76-C-0302)

(AD-A094909; TR-80-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a perspective on the initial transient problem in steady state simulation. In particular, it enumerates five generally accepted facts: (1) Conditions prevailing at the beginning of a simulation influence sample paths. (2) The extent of influence is a function of the strength of autocorrelation. (3) Some initial conditions are less detrimental than others. (4) Truncation reduces bias but usually increases variance. (5) So far no complete solution exists. The remainder of the paper describes a proposal for solving the problem. It relies on the relatively weak assumption that the conditional means in a stochastic process of interest are related linearly. An estimator of the steady state mean is described which has considerably less bias than one can achieve via conventional truncation. An interval estimator is also described which follows from standard regression theory. A test for residual bias is presented which enables a user to judge whether or not sample data meet the minimal requirements for the proposed technique to apply. A second test allows a user to judge whether or not a more efficient estimation technique can be used. GRA

N81-19837# Texas Univ. at Austin. Center for Cybernetic Studies.

NONPOLYNOMIAL AND INVERSE INTERPOLATION FOR LINE SEARCH SYNTHESIS AND CONVERGENCE RATES

J. Barzilai and A. Ben-Tal (Technion, Israel Inst. of Technol., Haifa) Dec. 1980 36 p refs

(Contracts N00014-75-C-0569; N00014-80-C-0242)

(AD-A095022; CCS-385) Avail: NTIS HC A03/MF A01 CSCL 12/2

The rate of convergence of line search algorithms based on general interpolating functions is derived and is shown to be independent of the particular interpolating function used. This result holds for the root finding problem f(x) = 0 as well. We show how inverse interpolation can be used in conjunction with the line search problem and derive its rate of convergence. Our analysis suggests that one point line search algorithms (in particular Newton's method) are inefficient in a sense. Two point algorithms using rational interpolating functions are recommended. GRA

N81-19838# Texas Univ. at Austin. Center for Cybernetic Studies.

MINIMIZATION BY INTERPOLATION: A SECOND ORDER GRADIENT ALGORITHM

Jonathan Barzilai Nov. 1980 8 p refs

(Contract N00014-75-C-0569)

(AD-A095024; CCS-387) Avail: NTIS HC A02/MF A01 CSCL 12/1

Newton's method for finding stationary point has second order of convergence. However, it necessitates computational and inversion of the second order derivatives matrix. Classes of algorithms are presented. One of these has second order of convergence while using first order information only. GRA

N81-19839# Texas Univ. at Austin. Center for Cybernetic Studies.

UNCONSTRAINED MINIMIZATION BY INTERPOLATION: RATES OF CONVERGENCE

J. Barzilai Dec. 1980 16 p refs

(Contract N00014-80-C-0242; NR Proj. 047-021)

(AD-A095025; CCS-389) Avail: NTIS HC A02/MF A01 CSCL 12/1

The main attraction of Newton's method for finding a stationary point is its quadratic convergence. However, it necessitates computation and inversion of the second order derivative matrix. Common minimization algorithms approximate the Hessian or its inverse by first order (i.e., gradient) information. First order information algorithms in common use are known to have at best superlinear rate of convergence. We analyze the rate of convergence of a new class of algorithms based on n-dimensional interpolation. In particular, we present a class of algorithms which use first order information only, while maintaining quadratic convergence. GRA

N81-19840# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.

Z-TRANSFORM TECHNIQUES FOR IMPROVED REAL-TIME DIGITAL SIMULATION OF CONTINUOUS SYSTEMS: RUNGE-KUTTA CONVOLUTIONS ADJUSTED FOR UNIT STEP RESPONSE VIA POLE-RESIDUES

Richard E. Dickson 1 Oct. 1980 23 p refs

(AD-A094743; AD-E950077; DRSMI/RD-81-1-TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An approximation for ZG(s)F(s) is developed using the second order Runge-Kutta integrator family. The residue for exact unit step response of a single real pole filter is then developed. The error for a complex exponential into a complex pole is also presented. GRA

N81-19841# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

THE FIELD OF ALGEBRAIC NUMBERS FAILS TO POSSESS EVEN A NICE SOUND, GIVEN RELATIVELY INCOMPLETE, HOARE-LIKE LOGIC FOR ITS WHILE-PROGRAMS

J. A. Bergstra (Leiden Univ.) Apr. 1980 17 p refs Submitted for publication

(MC-IW-136/80) Avail: NTIS HC A02/MF A01

Under a weak definition of a Hoare logic for WHILE-programs, interpreted in a structure A, it is shown that many familiar structures fail to admit even a sound, given relatively incomplete, Hoare logic for the partial correctness of their WHILE-program computations. Examples are Presburger arithmetic, the field of real algebraic numbers, and the field of algebraic numbers. Author (ESA)

N81-19842# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

STABILITY ANALYSIS OF REDUCIBLE QUADRATURE METHODS FOR VOLTERRA INTEGRAL EQUATIONS OF THE SECOND KIND

P. H. M. Wolkenfelt Feb. 1980 18 p refs Submitted for publication

(MC-NW-79/80) Avail: NTIS HC A02/MF A01

Direct quadrature methods, reducible to linear multistep methods for solving ordinary differential equations, are applied to a test equation of the convolution type. The difference equation for the numerical solution and the associated stability polynomial are derived. A definition of A sub 0-stability is given and it is shown that the direct quadrature methods considered cannot be A sub 0-stable. The boundary locus method is used to determine the regions of absolute stability. For the backward differentiation methods, diagrams of such regions are presented. Author (ESA)

N81-19843# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

GALERKIN METHODS FOR EVEN-ORDER PARABOLIC EQUATIONS IN ONE SPACE VARIABLE

M. Bakker Mar. 1980 31 p refs Submitted for publication

(MC-NW-81/80) Avail: NTIS HC A03/MF A01

For parabolic equations in one space variable with a strongly coercive self-adjoint 2m-th order spatial operator, a k-th degree Faedo-Galerkin method is developed which has local convergence of order 2(k+1-m) at the knots for the first m-1 spatial derivatives and, if k is equal or greater than 2m, convergence of order k+2 at specific interior nodal points. These nodal points are the zeros of the Jacobi polynomial P sup m, m, sub n (sigma) (n=k+1-2m) shifted to the segments of the partition. All these convergence properties are preserved if suitable quadrature rules are used. Author (ESA)

N81-19844# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

ROSENBROCK METHODS AND TIME-LAGGED JACOBIAN MATRICES

J. G. Verwer and S. Scholz (Tech. Univ., Dresden) Mar. 1980 18 p refs Submitted for publication

(MC-NW-82/80) Avail: NTIS HC A02/MF A01

In order to reduce the computation cost in the utilization of Rosenbrook type Runge-Kutta methods for solving stiff differential equations, the use of time-lagged Jacobian matrices is investigated. Integration is done with a fixed Jacobian, computed at some previous step, and the order of consistency is maintained by adapting the scalar integration parameters. Numerical experiments were performed, delivering in all cases a stable result. A decrease in the accuracy is found when the Jacobian is kept fixed. Author (ESA)

N81-19845# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

CONVERGENCE AND STABILITY ANALYSIS OF RUNGE-KUTTA TYPE METHODS FOR VOLTERRA INTEGRAL EQUATIONS OF THE SECOND KIND

P. J. vanderHouwen May 1980 19 p refs Submitted for publication

(MC-NW-83/80) Avail: NTIS HC A02/MF A01

Runge-Kutta type methods for Volterra integral equations of the second kind are studied which contain additional terms in order to extend the stability region. The order of convergence is derived and for kernel functions of the form K(x,y,f) = (A+Bx+Cy)f the stability behavior of the methods is considered by deriving the characteristic equation of the difference equation satisfied by the numerical solution. For a number of Runge-Kutta methods stability regions are given and the stabilizing effect of the additional terms is illustrated. Author (ESA)

N81-19846# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

TRAVELING WAVES IN AN INITIAL-BOUNDARY VALUE PROBLEM

E. J. M. Veling Feb. 1980 45 p refs Submitted for publication

(MC-TW-198/80) Avail: NTIS HC A03/MF A01

The initial boundary value problem is considered for a function u(x,t) satisfying a one dimensional semilinear diffusion equation on the half-bounded interval x equal or greater than 0. For a wide class of initial and boundary values, a uniformly valid asymptotic expression is given to which the solution converges exponentially. This expression is composed by a traveling wave and a solution of the stationary problem. Author (ESA)

N81-19847# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

FORCED PREY-PREDATOR OSCILLATIONS

J. G. Blom, R. deBruin, J. Grasman, and J. G. Verwer May 1980 19 p refs Submitted for publication

(MC-TW-201/80) Avail: NTIS HC A02/MF A01

The density fluctuations in a prey-predator ecological system are studied showing the shortcomings of the Volterra-Lotka equations. An improved model for prey-predator oscillations is developed, making one of the system parameters periodic in time. The existence and stability of subharmonic solutions are analyzed by Galerkin methods. It is concluded that the observed four and ten year cycles in prey-predator systems are due to seasonal fluctuations. Author (ESA)

N81-19848# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

STABILITY OF LINEAR MULTISTEP METHODS ON THE IMAGINARY AXIS

K. Dekker Jul. 1980 20 p refs Submitted for publication

(MC-NW-85/80) Avail: NTIS HC A02/MF A01

The stability of linear multistep methods of order higher than one is investigated for hyperbolic equations. By means of the Routh array and the Hermite-Biehler theorem, the stability boundary on the imaginary axis is expressed in terms of the error constant of the third order term. As a corollary, the stability boundary for methods of order higher than two is shown to be at most the square root of 3; this value is attained by the Milne-Simpson method. Author (ESA)

N81-19849# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.

EDGEWORTH EXPANSIONS FOR FUNCTIONS OF UNIFORM SPACINGS

R. J. M. M. Does and R. Helmers May 1980 11 p refs Submitted for publication

(MC-SW-55/80) Avail: NTIS HC A02/MF A01

Asymptotic expansions for the distribution functions of suitably normalized sums of a function of uniform spacings are established. Using a well-known characterization of the joint distribution of uniform spacings, the problem is reduced to that of deriving an asymptotic expansion for the distribution function of a normalized sum of independent random variables conditioned on another sum of independent random variables. This problem is then dealt with in a standard manner by applying classical results for sums of independent random vectors. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-19850# Naval Ocean Systems Center, San Diego, Calif.

APPLICATIONS OF STATISTICAL DISTRIBUTIONS IN

ACOUSTIC MODEL EVALUATION (LOG-GAMMA PROBABILITY DENSITY AND DISTRIBUTION CURVES ARE PRESENTED AS GRAPHICAL AIDS IN ASSESSING THE STATISTICAL CHARACTER OF PROPAGATION LOSS DATA)

R. W. McGirr 1 Jul. 1980 45 p refs
(AD-A094749; NOSC/TD-387) Avail: NTIS HC A03/MF A01 CSCL 12/1

Computer graphics have been incorporated into a model evaluation software package that is intended to provide insight into the statistics of propagation loss. Specifically, the user may optionally superimpose plots of theoretical distribution curves on empirical distribution displays. A tutorial review of the gamma distribution is presented in the context of multipath fluctuations, followed by a comprehensive discussion of the log-transformed gamma distribution. An example is included to illustrate the application of the maximum likelihood method of parameter estimation. GRA

N81-19851# Naval Research Lab., Washington, D. C.

CROSS-ENTROPY MINIMIZATION GIVEN FULLY-DECOMPOSABLE SUBSET AND AGGREGATE CONSTRAINTS Interim Report

John E. Shore 13 Feb. 1981 26 p refs
(RR014941)
(AD-A095179; NRL-MR-4430) Avail: NTIS HC A03/MF A01 CSCL 20/13

The principle of maximum entropy and the principle of minimum cross-entropy (minimum directed divergence, minimum discrimination information) have been applied recently to problems in queueing theory and computer system performance modeling. These information-theoretic principles estimate probability distributions based on information in the form of known expected values. In the case of queueing theory and computer system modeling, the known expected values arise from rate balance equations. This paper concerns situations in which the system state probabilities decompose into disjoint subsets and in which the known expected values are either expectations conditional on a specific subset or expectations involving aggregate subset probabilities. New properties of minimum cross-entropy distributions are derived and an efficient method of computing these distributions is derived. Computational examples are included. In the case of queueing theory and computer system modeling, the disjoint subsets correspond to internal device states and the aggregate probabilities correspond to overall device states. The results of this paper apply when one has both rate balance equations for device equilibrium involving internal device state probabilities as well as rate balance equations for system equilibrium involving aggregate device state probabilities. GRA

N81-19852# Massachusetts Inst. of Tech., Cambridge.

SOME GENERAL PRINCIPLES FOR THE DUAL PROBLEM TO STATISTICAL CLASSIFICATION

Lee K. Jones 26 Nov. 1980 28 p refs
(Contract F19628-80-C-0002; AF Proj. 627A)
(AD-A094726; TN-1980-55; ESD-TR-80-229) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider the design of decision problems which maximize the classification error for a given set of discriminants. A minimax principle is proved, which has applications in discriminant analysis and feature extraction. GRA

N81-19853# Massachusetts Inst. of Tech., Cambridge.

ON NONPARAMETRIC PROBABILITY DENSITY ESTIMATION USING ORTHOGONAL SERIES

Lee K. Jones 26 Nov. 1980 15 p refs
(Contract F19628-80-C-0002; AF Proj. 627A)
(AD-A094728; TN-1980-54; ESD-TR-80-230) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method of density estimation is proposed, which is a rational modification of orthogonal expansions, combined with a stopping rule determined by a nearest neighbor statistic. This method yields consistent estimates and applies (in principle) to density estimation in any number of dimensions. GRA

N81-19854# Claremont Mens Coll., Calif. Inst. of Decision Science.

COMPUTING LOWER CONFIDENCE BOUNDS WITH THE LIKELIHOOD RATIO METHOD

James B. Lucke Jan. 1981 27 p refs
(Contract N00014-78-C-0213)
(AD-A094895; Rept-81-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

Subroutines for computing lower confidence bounds are described that use the properties of the method to compute efficiently and avoid possible pitfalls of computing fixed points. GRA

N81-19855# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.

ACCEPTANCE CONTROL CHARTS WITH STIPULATED ERROR PROBABILITIES BASED ON POISSON COUNT DATA

Suresh Mhatre, Richard L. Scheaffer, and Richard S. Leavenworth Dec. 1980 33 p refs
(Contract N00012-75-C-0783)
(AD-A095013; RR-80-9) Avail: NTIS HC A03/MF A01 CSCL 12/1

An acceptance control charting scheme is investigated for the case in which observations consist of the number of nonconformances seen when a process is observed for a certain fixed length of time. The counts are assumed to have a Poisson distribution. Two normal approximations for finding the optimum sample size and control limit are compared to the exact values found through the use of Poisson (or Chi-square) probabilities. Recommendations for practical usage are made as a result of a numerical study. GRA

N81-19856# School of Aerospace Medicine, Brooks AFB, Tex. Advanced Analysis Branch.

ON TWO-SIDED CONFIDENCE AND TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS M.S. Thesis. Final Report, Jan. - May 1967

Alton J. Rahe Dec. 1980 81 p refs
(AF Proj. 7930)
(AD-A094899; SAM-TR-80-46) Avail: NTIS HC A05/MF A01 CSCL 12/1

This report gives known theorems on which the concept and construction of confidence and two types of tolerance limits for normal distributions are based. Procedures are presented for computing two sided confidence and tolerance limits for means and simple linear regression data (simultaneous and nonsimultaneous limits for each type). A numerical simple linear regression example is presented showing the six types of limits. An additional bibliography is given for reference on confidence and tolerance limits when information other than what is given in the report is desired. GRA

N81-19857# Texas A&M Univ., College Station. Inst. of Statistics.

A QUANTILE FUNCTION APPROACH TO THE K-SAMPLE QUANTILE REGRESSION PROBLEM

James Michael White Nov. 1980 119 p refs
(Contract DAAG29-80-C-0070)
(AD-A095077; TR-B-4; ARO-16992.4-M) Avail: NTIS HC A06/MF A01 CSCL 12/1

A procedure for estimating the parameters of a quantile regression function is investigated. The procedure is based on the work of Parzen (1979a) in the theory of quantile functions and is applicable to a wide range of distributional families. The procedure assumes the quantile functions of k populations to be location-scale shifts of a common quantile function. First, a goodness-of-fit procedure for determining the common distributional shape of the k populations generalizes the one population data modeling techniques of Parzen (1979a). An estimator of the shape parameter of a distribution is also investigated. The methods of Ogawa (1951) and Eubank (1979) are then used for estimating the location and scale parameters of the k populations. A regression model for the location and scale parameters is specified and the resulting estimators of the regression parameters are used to determine a regression function for any quantiles of the observed data. Finally, it is shown that inferences about the quantile relationships can be based on the asymptotic normality of the estimated parameters. The procedures are applied to some published data sets. GRA

N81-19858# Virginia Polytechnic Inst. and State Univ., Blacksburg.
SEQUENTIAL TESTS UNDER WEIBULL DISTRIBUTION
P. M. Ghare Dec. 1980 23 p refs Presented at the Reliability and Maintainability Symp., Philadelphia, Jan. 1981
(Grant DAAG29-78-G-0172)
(AD-A095058; RR-Q-7; ARO-15194.8-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The objective of this paper is to develop acceptance procedures based on a sequential probability ratio test when the system failures follow Weibull probability distribution. The acceptance procedures in both Military Handbook 108 and Mil-Std-781C are based on exponential distribution of failures. Exponential distribution implies a constant hazard rate. The Weibull distribution is much more comprehensive and, with suitable choice of parameters, can describe constant, increasing or decreasing hazard rates. GRA

N81-19859# California Univ., Berkeley. Operations Research Center.
ON THE CONSECUTIVE K-OF-N SYSTEM
Cyrus Derman (Columbia Univ., N.Y.), Gerald J. Lieberman (Stanford Univ., Calif.), and Sheldon M. Ross Nov. 1980 26 p refs
(Contracts N00014-75-C-0620; N00014-75-C-0561; N00014-77-C-0299; Grants AF-AFOSR-3213-77; NSF MCS-78-25-146; AF Proj. 2304)
(AD-A095139; ORC-80-25) Avail: NTIS HC A03/MF A01 CSCL 12/1

The consecutive k-of-n system in which there are n components linearly ordered is considered. Each component either functions or fails and the system is said to be failed if any k consecutive components are failed. Let r(p) = r(p(1), ..., p(n)) denote the probability that the system does not fail given that the components are independent, component i functions with probability p(i), i = 1, ..., n. The function r(p) is called the reliability function. The above system is studied both when the components are linearly ordered and also when they are arranged in a circular order. The case where all p(i) are identical and present a recursion for obtaining the reliability of a consecutive k-of-n in terms of the reliability of a consecutive k - 1 of n system is considered. This yields simple explicit formulas when k is small and differs from a recursion. How upper and lower bounds on r(p) can be simply obtained is shown. A dynamic version in which each component independently functions for random time having distribution F is considered. It is shown that when F is increasing failure rate (IFR), then system lifetime is also IFR only in the circular case when k = 2. A sequential optimization model in the linear k = 2 case is considered. In this model, components are put in place one at a time with complete knowledge as to whether the previous component has worked or not. GRA

N81-19860# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A MODIFIED KOLMOGOROV-SMIRNOV TEST FOR THE GAMMA WEIBULL DISTRIBUTION WITH UNKNOWN LOCATION AND SCALE PARAMETERS M.S. Thesis
Ramon Cortes Dec. 1980 113 p refs
(AD-A094732; AFIT/GOR/MA/80D-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

The Kolmogorov-Smirnov tables for the Weibull and Gamma distribution were generated in this thesis. These tables are used when testing whether a set of observations are from a Weibull (Gamma) distribution in which the location and scale parameters must be estimated from the sample. A power investigation of the test against some selected distributions using Monte Carlo techniques was conducted. This procedure shows that the test is reasonably powerful for a number of alternative distributions. A relationship between the critical values and the shape parameters was investigated for the Weibull and Gamma distributions. No apparent relationship was found for the Gamma distribution. In contrast, an approximate log-linear relationship was found for the Weibull when the shape parameter is between one and four. GRA

N81-19861# Arizona Univ., Tucson. Dept. of Mathematics.
DECOUPLING AND ORDER REDUCTION FOR LINEAR TIME-VARYING TWO-TIME SCALE SYSTEMS
Robert E. OMalley, Jr. and Leonard R. Anderson Jul. 1980 39 p refs Prepared in cooperation with Virginia Polytechnic Inst. and State Univ.
(Contract N00014-76-C-0326)
(AD-A094579; TR-27-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

The class of time varying linear systems which are two time scale on an interval may be decoupled by a time varying transformation of variables into separate subsystems containing the slow and fast dynamic parts. The transformation is obtained by solving a nonsymmetric Riccati differential equation backward in time. Small parameters are identified which measure the strength of the time scale separation and the stability of the fast subsystem. As these parameters go to zero, the order of the system is reduced and a useful approximate solution to the original system is obtained. The transformation is illustrated for examples with strong and weak fast subsystem stability. GRA

N81-19862# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
ESTIMATION OF LOCATION AND CRITERION OF TAILS
Jana Jureckova Sep. 1979 13 p refs Submitted for publication
(MC-SW-66/79) Avail: NTIS HC A02/MF A01

Let X1,...,Xn be a sample from a population with the density f(x-theta) such that f is symmetric and positive. It is proved that the tails of distribution of a translation-equivariant estimator of theta tend to 0 at most n times faster than the tails of basic distribution. The sample mean is shown good in this sense for exponentially-tailed distributions while it becomes poor if there is a contaminancy by a heavy-tailed distribution. The rates of convergence of the tails of robust estimators are shown to be bounded away from the lower as well as from the upper bound. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-19863 Cornell Univ., Ithaca, N. Y.
ON SOME GEOMETRICAL PROBLEMS IN TEICHMULLER AND TORELLI SPACES Ph.D. Thesis
Subhashis Nag 16 Mar. 1980 158 p
Avail: Univ. Microfilms Order No. 8102952

The Teichmuller modular group is known to act biholomorphically and isometrically on the Teichmuller space of Riemann surfaces, T, (equipped with the Teichmuller metric). The fix-point sets of these maps are complex submanifolds of T. Let f be an involutory element of the modular group. Since there is a unique geodesic in T joining any pair of distinct points, one can obtain a retraction, H sub F, of T onto the fix-point set of f by mapping any point x of T to the midpoint of the geodesic segment joining x and f(x). The fibers are characterized sub F is proved to be in terms of geodesics whose directions are determined by eigenvectors of the action of df on the tangent space to T at the fix-point x of f. An H sub f map on T(1,2) (the Teichmuller space of tori with two punctures) is investigated. A holomorphic retraction H from T(1,2) to the fix point set of f is defined. Additional problems are examined. Dissert. Abstr.

N81-19864 Kent State Univ., Ohio.
GEOMETRIC AND LINEAR TOPOLOGICAL PROPERTIES OF LORENTZ FUNCTION SPACES Ph.D. Thesis
Joseph Wilbourne Creekmore, III 1980 59 p

Avail: Univ. Microfilms Order No. 8100681

Lorentz function spaces are studied primarily from the point of view of interpolation theory. The Banach spaces are studied in an attempt to isolate some of their geometric and linear topological properties. It is shown that L sub W, p(mu), 1 < p < infinity is strictly convex, and another characterization of uniform convexity based on the weight function W(t) is given. L sub W, p(mu) admits an equivalent uniformly convex norm. It is proved that the original norm is uniformly convex. The property of smoothness is shown to fail in L sub W, p(mu), 1 < or = p < infinity. A cataloging of the type and cotype of the L sub pq(mu) spaces is given. The linear topological property of compactness is considered, and a characterization of relatively compact sets in L sub W, p (o, infinity), 1 < or = p < infinity, is given. Two geometric notions related to compactness packing and separated sets, are also considered. Dissert. Abstr.

N81-19865 Iowa State Univ. of Science and Technology, Ames.
COMPLETE SETS OF ORTHOGONAL TABLEAUX Ph.D. Thesis
Joseph Milton Clifton 1980 86 p
Avail: Univ. Microfilms Order No. 8103436

A prescription for writing down the matrices for the natural (integral) irreducible representation of the symmetric group Sn is given. Writing down the matrices using this prescription is rather tedious, and becomes computationally impossible for large n because of the need to calculate chains. The computation of the matrices for the natural (integral) irreducible representation of the symmetric group Sn is simplified by eliminating the need to calculate chains. The calculation of the chains is replaced by the simple act of setting up and inverting an upper triangular matrix, A(I). In many cases a set of tableaux which is not necessarily standard can be chosen so that A(I) is the identity matrix. Such a set of tableaux is called a complete set of orthogonal tableaux, and yields an equivalent representation of Sn in which all entries of the matrices are +1, -1, or 0. Dissert. Abstr.

N81-19866 Virginia Polytechnic Inst. and State Univ., Blacksburg.
NETS OF SETS AND APPLICATIONS TO TOPOLOGIES ON HYPERSPACES Ph.D. Thesis
Barbara Anne Flajnik 1980 117 p
Avail: Univ. Microfilms Order No. 8101879

Known results from the literature concerning nets of sets includes: a discussion of properties of limsup and liminf of a net of sets as subsets of the base space X; for example, how the sets limsup and liminf are relativized to a subspace of the space X is shown and the topological convergence of nets and sequences of sets is discussed. The investigation of a formula for liminf and results relevant to determining when a function preserves topological convergence are presented. The topology of convergence on 2x the set of all nonempty subsets of a topological space X is discussed. It is shown that when X is a T3 nonlocally compact space, the topology of convergence is strictly between the Vietoris topology and Fell's topology. We then discuss the properties of this topology of convergence. Dissert. Abstr.

N81-19867# Armstrong (Philip N.), Santa Ana, Calif.
SPARSE MATRIX COMPUTATIONS WITH A SPECIAL ARRAY-PROCESSOR Final Technical Report
Philip N. Armstrong and David G. Cantor 15 Dec. 1980 33 p refs
(Contract N00014-79-C-0477)
(AD-A094653) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is the final report of a study of special computing machinery for computations on sparse matrices. The elements of the computing system and its application to Gaussian elimination are described in some detail in the paper 'On a Special Purpose Matrix Array-Processor' by Philip N. Armstrong and David G. Cantor, which has been submitted for publication and comprises the major part of this report. This paper describes the system and the algorithms for which it is designed, so that a reader who is acquainted with computations on matrices will understand the system's utility for such computations. Some additional remarks regarding selected matrix computations may be useful and are included, although what is written may be inferred from the substance of the paper. Reading the paper is a prerequisite for these remarks. GRA

N81-19868# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ASYMPTOTIC PROPERTIES OF RANDOM SUBSETS OF PROJECTIVE SPACES
Douglas G. Kelly and James G. Oxley Dec. 1980 25 p refs
(Contract N00014-76-C-0550)
(AD-A094980; MIMEO-SER-1318) Avail: NTIS HC A02/MF A01 CSCL 12/1

A random graph on n vertices is a random subgraph of the complete graph on n vertices. By analogy with this, the present paper studies the asymptotic properties of a random submatroid omega(r) of the projective geometry PG(r-1,q). The main result concerns Kr, the rank of the largest projective geometry occurring as a submatroid of omega(r). We show that with probability one, for sufficiently large r, Kr takes one of at most two values depending on r. This theorem is analogous to a result of Bollobas and Erdos on the clique number of a random graph. However, whereas from the matroid theorem one can essentially determine the critical exponent of omega(r), the graph theorem gives only a lower bound on the chromatic number of a random graph. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-19869# Princeton Univ., N. J. Labs. of Physics.
HALL EFFECT NEAR THE MOBILITY EDGE: A SCALING ARGUMENT
Boris Shapiro 26 Jan. 1981 6 p refs
(Contract N00014-77-C-0711; NR Proj. 318-058)
(AD-A095121) Avail: NTIS HC A02/MF A01 CSCL 20/3

Critical behavior of the zero temperature Hall constant in a disordered electronic system is considered. It is shown, by means of a scaling argument, that near (above) the mobility edge Ec the Hall constant R diverges according to R(E) approximate (E-Ec) to the -t power, where t is the conductivity exponent. GRA

N81-19870# Naval Academy, Annapolis, Md. Dept. of Applied Science.
MAGNETIC FIELDS OF A HORIZONTAL ELECTRIC DIPOLE IN A SEMI-INFINITE MEDIUM Final Report, Jun. 1979 - Aug. 1980
L. K. Chi, B. R. Hood (David W. Taylor Naval Ship Research and Development Center), and F. A. Skove Aug. 1980 72 p refs
(AD-A094933; USNA-AS-1-80) Avail: NTIS HC A04/MF A01 CSCL 20/3

Various formulae for magnetic fields of horizontal electric dipoles in a semi-infinite medium have been derived. In the interest of providing the ability to evaluate the magnetic field strength interactively at on-site field locations, reduced expressions, which are valid in the quasi-static range, for the magnetic field were used in developing computer generated plots. Existing expressions were used to plot the field strength for ac and point dc dipoles with the receiver either in the medium or above the medium. In order to plot the special case of a finite length dc dipole with the receiver above the medium, the reduced expressions had to be derived. These new expressions, in addition to agreeing with Kraichman's point dipole expressions which are valid at a distance, also are valid with the receiver directly above the source. GRA

N81-19871# California Univ., Berkeley. Lawrence Berkeley Lab.
PHYSICS, COMPUTER SCIENCE AND MATHEMATICS DIVISION ANNUAL REPORT Period Covered: 1 Jan. - 31 Dec. 1979
J. V. Lepore, ed. Sep. 1980 104 p refs
(Contract W-7405-eng-48)
(LBL-11085) Avail: NTIS HC A06/MF A01

The major research effort of the Division remained High Energy Particle Physics with emphasis on preparing for experiments to be carried out at PEP. The largest effort in this field was for development and construction of the Time Projection

Chamber, a powerful particle detector. Software design for the Time Projection Chamber, was accomplished by the Computer Science and Applied Mathematics Department. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-19872# Materials Research Labs., Melbourne (Australia).
A REVIEW OF SOME PHYSICAL AND CHEMICAL FACTORS AFFECTING THE ATTENUATION OF LOW FREQUENCY SOUND IN SEAWATER
Daniel J. Whelan Jul. 1980 24 p refs
(MRL-R-782; AR-002-169) Avail: NTIS HC A02/MF A01

The contributions of various physical and chemical factors which effect the low frequency attenuation of sound observed in deep ocean channels are investigated. In particular the role of chemical relaxational processes in the overall attenuation of this sound is discussed. The evidence indicates that below 0.5 kHz, attenuation is affected predominantly by diffraction and diffusive scattering, but in the range 0.5 to 2.5 kHz, it is the effects of chemical relaxation processes, involving boric acid/borate and magnesium/carbonate equilibria, which dominate the sound absorption phenomenon. M.G.

N81-19873*# Pennsylvania State Univ., University Park. Noise Control Lab.
FREE-FIELD PROPAGATION OF HIGH INTENSITY NOISE Semiannual Report
Oliver H. McDaniel, S. David Roth, and Joseph P. Welz 18 Mar. 1981 30 p refs Presented at Shock Noise Workshop, Cleveland, 5 Dec. 1980
(Grant NAG1-4)
(NASA-CR-164032) Avail: NTIS HC A03/MF A01 CSCL 20A

Research on high intensity (finite amplitude) acoustic waves shows that nonlinear distortion effects generally result in a shift of energy to higher frequencies. The higher intensities associated with supersonic jets would therefore indicate that high frequency enhancement of the spectrum should occur, resulting in the differences observed between subsonic and supersonic jets. A 10,000 acoustic watt source installed in an anechoic chamber generates sound levels such that acoustic shocks are readily observable. Dual frequency excitation of the source produces a strong parametric effect with a difference frequency comparable in level to the primary frequency. The test set up and recording equipment being used to determine the finite amplitude noise representative of an actual supersonic jet are described as well as the development of a computer program based on Burger's equation. The spectra of 1/2 octave band, 1 kHz sine wave, and dual frequency input and output are presented in graphs along with waveforms at Z = .025, 0.1, and 1.0. A.R.H.

N81-19874*# Ohio State Univ., Columbus. Dept. of Engineering Mechanics.
FUNDAMENTAL ASPECTS IN THE QUANTITATIVE ULTRASONIC DETERMINATION OF FRACTURE TOUGHNESS: GENERAL EQUATIONS
L. S. Fu Dec. 1980 29 p refs
(Grant NsG-3269; RF Proj. 761641/711992)
(NASA-CR-164023) Avail: NTIS HC A03/MF A01 CSCL 20A

Definition and general equations for time harmonic displacement and strain fields in a pair of interacting inhomogeneities are given. The interaction problems are presented via the dynamic eigenstrain concept. This approach converts the problem of dealing with inhomogeneous boundary conditions to that of dealing with a nonhomogeneous differential equation. The nonhomogeneous term is directly related to the strains and displacements in the scatterer and can be obtained by the method of equivalent inclusions. M.G.

N81-19875*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE PROPAGATION OF LONG WAVES IN ACOUSTICALLY TREATED, CURVED DUCTS
W. Rostafinski 1981 21 p refs Proposed for presentation at 101st Meeting of the Acoust. Soc. of Am., Ottawa, 18-22 May 1981
(NASA-TM-81712; E-745) Avail: NTIS HC A02/MF A01 CSCL 20A

A two dimensional study is presented on the behavior of long waves in lined, curved ducts. The analysis includes a comparison between the propagation in curved and straight lined ducts. A parametric study was conducted over a range of wall admittance and duct wall separation. The complex eigenvalues of the characteristic equation, which in the case of a curved duct are also the angular wavenumbers, were obtained by successive approximations. Author

N81-19876# Naval Research Lab., Washington, D. C.
OCEAN ENVIRONMENTAL INFLUENCES OF TEMPERATURE AND MECHANICAL STRESSES ON BARE FIBER-OPTIC SENSORS OF ACOUSTIC PRESSURES, PART 1 Final Report
Sam Hanish 6 Jan. 1981 66 p refs
(AD-A094659; NRL-8424) Avail: NTIS HC A04/MF A01 CSCL 20/6

A theoretical analysis is made of the signal-to-noise ratio of a fiber optic hydrophone based on general forms of power spectra of random environmental noise. The signal is a single frequency acoustic pressure wave. The noise is a sum of shot noise, laser jitter, environmental temperature fluctuations and environmental mechanical stress fluctuations. Environmental effects are discussed in terms of autocorrelation functions and power spectra. Explicit formulas are derived for the case of Gaussian autocorrelations. A detailed investigation is undertaken of the effects of temperature fluctuations in the ocean on the phase stability of the signal beam. Both large scale temperature fluctuations caused by internal waves and small scale fluctuations caused by velocity turbulence and thermal diffusion are considered. Numerical calculations are made of specific cases of interest. It is concluded that the stability of phase is either strongly affected or moderately affected, depending on the length of the fiber exposed to the medium, the depth in the ocean, the track length of towed sensors, the time of exposure in moored sensors, and the characteristics of built-in instrumental spectral windows. GRA

N81-19877# CACI, Inc. - Federal, Arlington, Va.
INM, INTEGRATED NOISE MODEL, VERSION 2. INSTALLATION INSTRUCTIONS
Mary Catherine Flythe Jan. 1981 62 p refs
(Contract DOT-FA79WA-4295)
(AD-A095060; FAA-EE-80-50) Avail: NTIS HC A04/MF A01 CSCL 20/1

This document provides the necessary instructions for programming personnel to install Version 2.7 of the Integrated Noise Model (INM) on the CDC 6000, Cyber 170 or IBM S/360-370 computers. The manual describes the model history, the model components, the hardware and software requirements, the characteristics of the model release tapes, the installation procedures and the execution procedures. The instructions contained within this manual apply to INM Version 2.7 magnetic tapes released after January 1, 1981. The installation instructions for CDC compatible tapes released between September 1979 and January 1981 are contained in 'INM, Integrated Noise Model, Version 2 - Programmer's Guide' (Report No. FAA-EE-79-10). GRA

N81-19878# California Univ., Livermore. Lawrence Livermore Lab.
FINITE AMPLITUDE EXTENSION OF GEOMETRIC ACOUSTICS IN A MOVING, INHOMOGENEOUS ATMOSPHERE
S. I. Warshaw 9 Sep. 1980 22 p refs
(Contract W-7405-eng-48)
(UCRL-53055) Avail: NTIS HC A02/MF A01

The theory of linear geometric acoustics as developed by Blokhintsev is extended to the nonlinear acoustic regime by applying the method of Riemann invariants to the propagation of acoustically small pulses along ray paths in a moving, inhomogeneous, thermoviscous medium. Blokhintsev's derivation is reviewed in detail and is used to define an almost Galilean

transformation of the nonlinear propagation equations from a quiescent to a moving medium. The nonlinear convective and dissipative processes are assumed to have a negligibly small effect on the ray paths. The differential equations of the ray paths and the propagation of the pulses are presented and specialized to the example of a horizontally moving, gravitationally stratified atmosphere. DOE

N81-19879# National Physical Lab., Teddington (England). Acoustics Unit.
A REVIEW OF AIRCRAFT NOISE PROPAGATION
D. F. Pernet Oct. 1979 69 p refs
(NPL-Ac-92) Avail: NTIS HC A04/MF A01

Factors affecting the attenuation rate measurement accuracy from investigations of aircraft noise propagation were examined. Estimates of the relative importance of these factors are made, considering in particular noise source, atmospheric medium and acoustic measurement. A number of studies were examined in detail and recommendations are made on how to improve data reliability and data interpretation. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-19880 General Electric Co., Whetstone (England).
SNUG: A FORTRAN PROGRAM TO CALCULATE RADIATION LEVELS FROM A POINT, LINE OR CYLINDRICAL SOURCE
G. D. Roberts Nov. 1978 22 p
(REL/R(78)36) Avail: NTIS HC A02

A FORTRAN program SNUG (Shielding Nearly Universal Geometry) is described for calculating gamma radiation levels from point, line or cylindrical sources. The program can deal with more than one source, but all sources must be of the same type. The cylindrical source may be absorbing or nonabsorbing. Dose points may be located anywhere in the system, including points above and inside (cylindrical) the source. The source activity remains constant both radially and along the length of the source. An amendment facility is available in which specific cases may be amended as required. The program runs on a PDP 11 computer. Author (ESA)

N81-19881*# Battelle Columbus Labs., Ohio.
QUANTUM CHEMICAL CALCULATION OF THE EQUILIBRIUM STRUCTURES OF SMALL METAL ATOM CLUSTERS Annual Progress Report, 1 Apr. 1980 - 29 Feb. 1981
Luis R. Kahn 27 Mar. 1981 78 p refs
(Grant NsG-2027)
(NASA-CR-164035) Avail: NTIS HC A05/MF A01 CSCL 20H

A decomposition of the molecular energy is presented that is motivated by the atom superposition and electron delocalization physical model of chemical binding. The energy appears in physically transparent form consisting of a classical electrostatic interaction, a zero order two electron exchange interaction, a relaxation energy, and the atomic energies. Detailed formulae are derived in zero and first order of approximation. The formulation extends beyond first order to any chosen level of approximation leading, in principle, to the exact energy. The structure of this energy decomposition lends itself to the fullest utilization of the solutions to the atomic sub problems to simplify the calculation of the molecular energy. If nonlinear relaxation effects remain minor, the molecular energy calculation requires at most the calculation of two center, two electron integrals. This scheme thus affords the prospects of substantially reducing the computational effort required for the calculation of molecular energies. M.G.

N81-19882# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
RESEARCH IN DIFFERENTIAL CROSS-SECTIONS WITH LASER-EXCITED ATOMS Thesis [UNTERSUCHUNGEN DIFFERENTIELLER WIRKUNGSQUERSCHNITTE MIT LASERRANGEREGTEN ATOMEN]
Wolfgang Groeger Nov. 1979 81 p refs In GERMAN
(MPIS-22/1979; ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15,15

A cross molecular laser apparatus was designed to measure scattering cross sections of thermal energy in the exchange of sodium with argon and for sodium with argon into an electronic simulated state. Typical structures were measured for flexible dispersion in differential cross sections of the multistate exchange. Measurements show a well resolved oscillation structure and quantomechanic computation and prove that these structures can be traced back to flexible dispersion. Results indicate an initially critical test with potential computations. Results obtained for the system are in agreement with results obtained from spectroscopic experiments. Transl. by E.A.K.

N81-19883# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
ELECTRONIC ENERGY LEVELS OF INTERMEDIATES IN THE LABORATORY Interim Technical Report
I. A. Howard and Gary Horlick 31 Dec. 1980 28 p refs
(Contract N00014-76-C-0838)
(AD-A094063; Rept-13) Avail: NTIS HC A03/MF A01 CSCL 07/1

Using the multiple scattering X-alpha method, electronic energy levels have been found self-consistently for the intermediates Ni(CO)(n), n = 1,2,3 in the formation of nickel tetracarbonyl via the Ni-CO surface reaction. Linear geometries have been assumed for NiCO and Ni(CO)2, and a trigonal planar conformation for Ni(CO)3, in accordance with previously published IR spectra. The intermediates were assumed to be in the gas phase, free of surface interaction. From the energy level structure found, all three of the intermediates were determined to be diamagnetic, as Ni(CO)4 is known to be. GRA

N81-19884# Chicago Univ., Ill. James Franck Inst.
EXPERIMENTAL AND THEORETICAL STUDIES OF INTRAMOLECULAR AND INTERMOLECULAR DYNAMICS Final Report, 1 Oct. 1979 - 30 Sep. 1980
Stuart A. Rice 30 Sep. 1980 12 p
(Grant AF-AFOSR-0004-80; AF Proj. 2303)
(AD-A094486; AFOSR-81-0062TR) Avail: NTIS HC A02/MF A01 CSCL 20/10

Significant progress was made in both experimental and theoretical studies of intramolecular and photochemical processes. The concept of kolmogorov entropy was extended to the quantum mechanical case and has been used to interpret the nature of chaos in quantum mechanical systems. A detailed study of radiationless processes in cold isolated naphthalene was completed and in which the first evidence for a promoting mode was identified. Striking quantum mechanical effects in very low energy collisions of atoms with polyatomic molecules was discovered. A detailed study of collision induced energy exchange in electronically excited pyrazine was completed and which resulted in the development of a correlation type theory of the rules governing such processes. Finally, a joint theoretical and experimental study of the effect of initial rotational state selection of photophysical and photochemical processes has been completed. GRA

N81-19885# Princeton Univ., N. J. Lab. of Physics.
THE STABILITY OF PERIODIC ORBITS
Leigh Sneddon 21 Jan. 1981 38 p refs Submitted for publication
(Contract N00014-77-C-0711; NR Proj. 318-058)
(AD-A094872) Avail: NTIS HC A03/MF A01 CSCL 07/4

The linear stability analysis of a periodic orbit, X(O) (T), of a dynamical system X = F(X), is related to the anomalous ferromagnetic resonance properties of ferrites. It is shown to have a continuous sequence of normal mode problems associated with it. This sequence defines a natural set of coordinate axes which allow the stability analysis to be put in a form which has already been dealt with analytically in the ferrite resonance theory. A simplification which allowed the basic experimental properties to be accounted for is applied to the stability analysis. The simplified analytic solution is obtained for three-mode systems.

its properties and consequences are discussed and it is checked against some rigorous results. Author (GRA)

N81-19886# Kansas Univ., Lawrence. Dept. of Chemistry.
DEVELOPMENT OF EMPIRICAL POTENTIAL FUNCTIONS FOR THE STUDY OF MOLECULAR GEOMETRY AND APPLICATIONS TO CHLOROPHYLL A DIMERS Ph.D. Thesis
T. Oie 1980 128 p refs
(Contract DE-AS02-76ER-02837)
(DOE/ER-02837/T2) Avail: NTIS HC A07/MF A01

The reliable estimate of geometric structures and energies of large molecules by quantum mechanical methods is not possible at the present time. For the studies of large molecular systems, an empirical potential function (EPF) which could suffice this purpose, is proposed. Because of a large number of variable chemical compositions and functional groups characteristically present in a large molecule, it is important to include a large number of structurally diverse molecules in the development of the EPF. The EPF is applied to study the geometrical structure of a chlorophyll, a (Chl a) dimer, which is believed to exist at the photoreaction center of green plants and is known to play an essential role in photosynthetic energy conversion. The structural stabilities of various dimer models are examined by the EPF and quantitative information on the structure and stability of these models is provided. DOE

N81-19887# California Univ., Livermore. Lawrence Livermore Lab.
INTERACTION OF MODERATELY DENSE PARTICLE CONCENTRATIONS IN TURBULENT FLOW
Alfred C. Buckingham and Wighert J. Siekhaus 1981 16 p refs Presented at the 19th AIAA Aerospace Sci. Meeting, Air Breathing Propulsion Sect., St. Louis, 12-15 Jan. 1981
(Contract W-7405-eng-48)
(UCRL-84559; AIAA-Paper-81-0346) Avail: NTIS HC A02/MF A01

Numerical simulations are presented which describe fluctuating gas motions and effects of resulting forces on gas borne particulates. The effects include the back influence of the particulates on the turbulent gas field that convects them. Force, energy and motion coupling between particles and gas is moderately influential consistent with the modest levels of particle to gas mass loading (the order of 0.01 to 0.1), associated with use of erosion suppressing particulate additives. Back influence consists of inertial and volumetric effects as well as modeled acoustical coupling, where appropriate. Preliminary results of complementary wind tunnel experiments, measuring influences of particle loading in turbulent structures, are also presented. DOE

N81-19888# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
TRANSPORT OF LOW ENERGY POSITIVE AND NEGATIVE ION BEAM BY PERMANENT MAGNETS
K. N. Leung, K. W. Ehlers, and E. B. Hooper, Jr. Oct. 1980 7 p refs Presented at the 2d Intern. Symp. on the Prod. and Neutralization of Negative Hydrogen Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11636) Avail: NTIS HC A02/MF A01

An experimental investigation of low energy ion beam guiding by a surface magnetic field generated by samarium cobalt magnets has been performed. It was found that magnets arranged in a multi-ring cusp configuration produced the best beam transport efficiency, in agreement with calculation of the charged particle trajectories for this particular magnet arrangement. This geometry is predicted to yield no distortion in the phase space of the beam. The effect is proportional to charge squared and is therefore independent of the sign of the charge of the particle being transported. DOE

N81-19889# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
SELECTIVITY IN MULTIPLE QUANTUM NUCLEAR MAGNETIC RESONANCE Ph.D. Thesis
W. S. Warren Nov. 1980 349 p refs
(Contract W-7405-eng-48)
(LBL-11885) Avail: NTIS HC A15/MF A01

The theory of multiple quantum Nuclear Magnetic Resonance (NMR) is developed through the density matrix formalism and exact intensities are derived for several cases (isotropic first order systems and anisotropic systems with high symmetry) to show that this intensity decrease is expected if standard multiple quantum pulse sequences are used. Pulse sequences are developed which excite coherences and produce population inversions only between selected states, even though other transitions are simultaneously resonant. One type of selective excitation presented only allows molecules to absorb and emit photons in groups of n. Coherent averaging theory is extended to describe these selective sequences and to design sequences which are selective to arbitrarily high order in the magnus expansion. This theory and computer calculations both show that extremely good selectivity and large signal enhancements are possible. DOE

N81-19890# State Univ. of New York, Stony Brook. Dept. of Chemistry.
STABLE ISOTOPE STUDIES. Annual Progress Report, 1 Mar. 1980 - 28 Feb, 1981
28 Oct. 1980 110 p refs
(Contract DE-AC02-80ER-10612)
(DOE/ER-10612/1) Avail: NTIS HC A06/MF A01

Vapor pressures of (12)CHF3, (13)CHF3, and (12)CDF3 were measured between -147 and -60(0)C. The normal isotope effect of deuterium with a positive slope and the inverse isotope effect of (13)C with a negative slope in the plot of T 1n(p'p) vs 1/T are simultaneously explanable only in terms of a blue-shift in the C-H stretching frequency upon condensation of fluoroform molecules. Vapor pressures of (12)CH3F, (13)CH3F, and (12)CD3F were also measured between -141 and -60(0)C. The deuterium effect is a normal isotope effect with a large positive slope. The (13)C effect is an inverse isotope effect with a slightly positive slope. A nitrogen-15 exchange column based on the pressurized NO/N2O3 system was constructed. New refluxer designs were developed. Two FORTRAN programs have been written for studies of differential isotope effect. DOE

N81-19891# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MEASUREMENTS OF IONIZATION BALANCE PARAMETERS IN ATOMIC IONS Progress Report, 1 May - 30 Nov. 1980
J. L. Kohl Dec. 1980 12 p
(Contract DE-AC02-80ER-10631)
(DOE/ER-10631/1) Avail: NTIS HC A02/MF A01

The measurement of parameters which govern the charge distribution of atomic ions in high temperature plasmas is discussed. A measurement of the absolute cross section for dielectronic recombination in C(+3) involving the 2s-2p stabilizing transition is reported. Also reviewed are required modifications to the Ion Beam Facility, preliminary photon measurements which are used to identify and correct problems and evaluate techniques and apparatus, radiometric calibration of the photon optical and detection system, and design and fabrication of the apparatus for analysis and detection of ions. DOE

N81-19892# Los Alamos Scientific Lab., N. Mex.
EDGE ENVELOPE EQUATION FOR A BALLISTICALLY FOCUSED NEUTRALIZED ION BEAM
D. S. Lemons and Lester E. Thode Nov. 1980 10 p refs
(Contract W-7405-eng-36)
(LA-8600-MS) Avail: NTIS HC A02/MF A01

An envelope equation for a cold ion beam with overall charge and current neutralization provided by a coflowing electron gas obeying an adiabatic equation of state was derived. The deviation assumes the beam evolves self similarly with the ion at the edge of a uniform density ion profile. Numerical and approximate analytical solutions were calculated. DOE

N81-19893# Paris-Sud Univ., Orsay (France). Lab. of Plasma Physics.
EXCITATION TRANSFER FROM He AND Ar METASTABLE ATOMS TO THE NITROGEN MOLECULE
A. Ricard Nov. 1979 25 p refs Presented at 32nd Ann. Gaseous Electron. Conf., Pittsburgh, 9-12 Oct. 1979

(LP-175; MA-1) Avail: NTIS HC A02/MF A01

The vibrational distribuion of the N2 C and B states and the rotational excitation of the C state were studied. A flowing afterglow device was used to study excitation transfer. Metastable atom densities were measured by optical absorption. From anomalies in the fine structure of the C rotational lines it was possible to describe the steps of the collision process. It is concluded that the branching ratio for the N2 C and B state production is lower than the values of 10% for C and 60% for B that were previously published. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N81-19894# Naval Research Lab., Washington, D. C. Plasma Theory Branch.

STABILITY PROPERTIES OF AZIMUTHALLY SYMMETRIC PERTURBATIONS IN AN INTENSE ELECTRON BEAM Interim Report

Han S. Uhm and Martin Lampe 3 Feb. 1981 50 p refs (ARPA Order 3718)

(AD-A094535; NRL-MR-4441) Avail: NTIS HC A03/MF A01 CSCL 20/8

The Vlasov-Maxwell equations are used to investigate the stability of azimuthally symmetric perturbations (e.g., sausage and hollowing modes) of an electron of ion beam immersed in a resistive plasma. The perturbed space charge and plasma current are treated self-consistently for any value of the plasma conductivity. A similar analysis of the hose instability is also carried out. The analysis is carried out for the 'loss-cone' distribution function in which all of the beam electrons have the same value of energy and the same value of axial canonical momentum. In the high conductivity regime, the system is shown to be strongly destabilized by a sufficiently large value of the fractional current neutralization. GRA

N81-19895# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).

[ACTIVITIES IN THE FIELD OF NUCLEAR PHYSICS, 1979] Annual Report

1979 99 p refs

Avail: NTIS HC A05/MF A01

The activities of the nuclear physics laboratory are reported including the work done in the areas of electron scattering, muon and hadron physics, particle theory, and radio and nuclear chemistry. The laboratory facilities are described including the particle accelerator installation. Author (ESA)

74 OPTICS

Includes light phenomena.

N81-19896* National Aeronautics and Space Administration. Pasadena Office, Calif.

SYSTEM AND METHOD FOR CHARACTER RECOGNITION Patent

Jung Pyo Hong, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Issued 29 Oct. 1974 13 p Filed 31 Jul. 1972 Continuation-in-part of abandoned US Patent Appl. SN-090584, filed 18 Nov. 1970 Sponsored by NASA

(NASA-Case-NPO-11337-1; NASA-Case-NPO-11575-1; US-Patent-3,845,466; US-Patent-Appl-SN-276599; US-Patent-Appl-SN-090584; US-Patent-Class-340-146.3S; US-Patent-Class-340-146.3H; US-Patent-Class-340-146.3Y) Avail: US Patent and Trademark Office CSCL 20F

A character recognition system is disclosed in which each character in a retina, defining a scanning raster, is scanned with random lines uniformly distributed over the retina. For each type of character to be recognized the system stores a probability density function (PDF) of the random line intersection lengths and/or a PDF of the random line number of intersections. As an unknown character is scanned, the random line intersection lengths and/or the random line number of intersections are accumulated and based on a comparison with the prestored PDFs a classification of the unknown character is performed.

Official Gazette of the U.S. Patent and Trademark Office

N81-19897 Kent State Univ., Ohio.

X-RAY AND OPTICAL STUDIES OF SEVERAL SMECTIC PHASES Ph.D. Thesis

Arun Ekachal 1980 131 p

Avail: Univ. Microfilms Order No. 8100683

The smectic A, B, C, I, and X phases of five compounds were studied by X-ray diffraction methods along with microscope observations. The individual molecules of all phases appear to be tilted with respect to the layer normal. The smectic A phase is a disordered uniaxial phase with a large average tilt angle thereby causing the layer spacing to be much less than the molecular length. The symmetric molecular distribution makes the phase optically uniaxial. The smectic C phase is disordered and less symmetric than the A phase. The asymmetric distribution of the molecules results in an optically observable tilt angle. The preferred angle and the order parameter of both phases are calculated. The smectic B, I and X phases are ordered smetic phases that give similar X-ray diffraction patterns and have comparable d/l ratios, where d is the layer spacing and l is the molecular length. The differences between them are that the B phase is a uniaxial phase, the I phase is a tilted biaxial phase, and the X phase is a non-tilted biaxial phase. The B-X phase transition appears to be second order like the A-C phase transition. Model structures for these phases are proposed. Dissert. Abstr.

N81-19898* National Aeronautics and Space Administration. Pasadena Office, Calif.

X-RAY POSITION DETECTOR Patent

Gordon Garmire, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Issued 28 Nov. 1972 4 p Filed 4 Dec. 1970

(NASA-Case-NPO-12087-1; US-Patent-3,704,284; US-Patent-Appl-SN-095217; US-Patent-Class-250-83.6R) Avail: US Patent and Trademark Office CSCL 20F

An X-ray position detector for real time operation is described. A set of proportional counters is arranged into an array which can detect and indicate the position of an X-ray interaction within the array, in the X Y plane.

Official Gazette of the U.S. Patent and Trademark Office

N81-19899*# National Aeronautics and Space Administration. Pasadena Office, Calif.

OPTICAL SIGNATURE GENERATING AND CORRELATING APPARATUS Patent Application

Robert W. Armstrong, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 10 Feb. 1981 21 p

(Contract NAS7-100)

(NASA-Case-NPO-15226-1; US-Patent-Appl-SN-233274) Avail: NTIS HC A02/MF A01 CSCL 20F

An image sensor of the charge coupled device (CCD) type is described which can automatically generate a signature, representing an optical image, to facilitate cross correlation with another image. A transfer detecting device is provided at an edge of each pixel of the array to detect the magnitude of the charge representing the light which fell on the pixel. A conductor is connected in parallel to all detecting devices of a row of pixels to generate an output representing the light falling on an entire row of pixels. Another group of transfer detecting devices is provided which can detect a second transfer of charges which were originally transferred out of the pixels. Each column of second transfer detecting devices is likewise connected to another conductor. The charge gathered by each conductor can be transferred directly to a cell of a CCD register of a cross correlating device. NASA

N81-19900*# Battelle Memorial Inst., Columbus, Ohio.

AN INVESTIGATION FOR THE DEVELOPMENT OF AN INTEGRATED OPTICAL DATA PREPROCESSOR Final Report, 15 Dec. 1978 - 30 Oct. 1980

C. M. Verber, R. P. Kenan, N. F. Hartman, and C. M. Chapman

Oct. 1980 54 p refs
(Contract NAS1-14655)
(NASA-CR-165636) Avail: NTIS HC A04/MF A01 CSCL 20F

A laboratory model of a 16 channel integrated optical data preprocessor was fabricated and tested in response to a need for a device to evaluate the outputs of a set of remote sensors. It does this by accepting the outputs of these sensors, in parallel, as the components of a multidimensional vector descriptive of the data and comparing this vector to one or more reference vectors which are used to classify the data set. The comparison is performed by taking the difference between the signal and reference vectors. The preprocessor is wholly integrated upon the surface of a LiNbO3 single crystal with the exceptions of the source and the detector. He-Ne laser light is coupled in and out of the waveguide by prism couplers. The integrated optical circuit consists of a titanium infused waveguide pattern, electrode structures and grating beam splitters. The waveguide and electrode patterns, by virtue of their complexity, make the vector subtraction device the most complex integrated optical structure fabricated to date. A.R.H.

N81-19901# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DISPERSION OF X-RAYS FROM POLISHED SURFACES [DIE STREUUNG VON ROENTGENSTRAHLEN AN POLIERTEN OBERFLAECHEN]
Guenther Hasinger May 1980 69 p refs In GERMAN
(MPI-PAE/Extraterr-163; ISSN-0340-8922) Avail: NTIS HC A04/MF A01

The development of the 80 cm telescope with dependence on leakage of wavelengths and angle of incidence as well as with the exact determination of the surface parameters with extremely well polished X-ray mirrors is discussed. Two approaches were put forward: (1) the physical relationship of X-ray dispersion to surface, and (2) to improve technologically the dispersion theory. The first goal was to improve diagnostics and the second goal was to simplify the interrated processes in the manufactured complicated mirror systems. The dispersion characteristics of mirrors was also tested for radiation of higher energies which are not absorbed by air. The value of the dispersion theory was tested with evidence of air presence and extrapolated without further application of weak radioactivity. Both theories show small radiation dispersions which are equivalent on statistically raw surfaces. Transl. by E.A.K.

N81-19902# ARO, Inc., Arnold Air Force Station, Tenn.
INFRARED OPTICAL PROPERTIES OF SOLID MIXTURES OF MOLECULAR SPECIES AT 20 K Final Report, 1 Oct. 1979 - 1 Feb. 1980
K. F. Palmer, B. E. Wood, and J. A. Roux AEDC Jan. 1981 134 p refs Sponsored by AF
(AD-A094214; AEDC-TR-80-30) Avail: NTIS HC A07/MF A01 CSCL 20/6

Infrared transmittance spectra were measured by a Fourier transform spectrometer for 20 K cryofilms of homogeneous mixtures of N2, Ar, NH3, CO, CO2, and H2O molecules. Such cryofilms may contaminate cryogenic optical surfaces of spacecraft or aircraft. The films, cryopumped onto a 20 K germanium substrate, varied from 0.24 to 13 micrometers thick. The spectral domain ranged from 500 to 3700/cm. For all films, the complex refractive index (n - n - iK) was determined at each wavenumber by fitting the experimental behavior of the transmittance with film thickness to a lamellate model of the film and substrate. The model accounts for beam reflection losses as well as attenuation caused by passing the beam through the film and substrate materials. A Kramers-Kronig (KK) technique for obtaining the n values is compared with the thin-film determination of n. GRA

N81-19903# Corning Glass Works, N.Y.
SINGLE MODE OPTICAL WAVEGUIDE DESIGN INVESTIGATION Progress Report, Oct. - Nov. 1980
V. A. Bhagavatula, R. A. Westwig, and D. B. Keck 4 Dec. 1980 4 p refs Sponsored by Navy
(AD-A094563; PR-1) Avail: NTIS HC A02/MF A01 CSCL 20/6

This report outlines the progress made during the period Oct.-Nov. '80, in carrying out the 'Single-mode Optical Waveguide Design Investigation.' The report summarizes the work performed in the following areas: (1) Microbend Sensitivity Test; (2) Fabrication; (3) Equipment Assembly. GRA

N81-19904# Naval Research Lab., Washington, D. C. Acoustics Div.
OCEAN ENVIRONMENTAL INFLUENCES OF TEMPERATURE AND MECHANICAL STRESS ON BARE FIBER-OPTIC SENSORS OF ACOUSTIC PRESSURES, PART 2 Final Report
Sam Hanish 21 Jan. 1981 48 p refs
(ZF11121004)
(AD-A094611; NRL-8425) Avail: NTIS HC A03/MF A01 CSCL 20/6

The effect of extraneous (environmental) mechanical stress on the state of polarization of light signals in fiber-optic sensors of acoustic pressure is investigated. After review of the relevant theory of the propagation of polarized light in a dielectric waveguide and of photoelastic coupling, more specific cases of the birefringent effects of mechanical stress are theoretically analyzed and numerically calculated. It is concluded that these effects are negligible in the cases treated except for fibers subject to equal and opposite forces along a diameter or subject to random pressure fluctuations. Estimates of differential changes in the index of refraction in silica fibers due to (elastic) stress-induced birefringence are furnished. GRA

N81-19905# ARO, Inc., Arnold Air Force Station, Tenn.
INFRARED STANDARDS TO IMPROVE CHAMBER 7V BEAM IRRADIANCE CALIBRATIONS Final Report, 1 Oct. 1979 - 30 Sep. 1980
F. G. Sherrell AEDC Jan. 1981 48 p refs Sponsored by Air Force
(AD-A094658; AEDC-TR-80-45) Avail: NTIS HC A03/MF A01 CSCL 17/5

A working standard, low temperature, blackbody has been developed for use in establishing radiometric calibrations that are directly traceable to the National Bureau of Standards. The blackbody will be used in the process of establishing a calibration of the 7V beam irradiance, as required for LWIR sensor testing. The 7V beam irradiance calibration process is reviewed to indicate the manner in which the working standard blackbody fits into the overall calibration scheme. A complete description of the design and calibration of the working standard blackbody is presented. The device is utilized to calibrate a phosphorous-doped, silicon bolometer and the bolometer calibration procedure and results are also presented. In the overall 7V beam irradiance calibration process, the bolometer will be used to calibrate the operational sources that are utilized in 7V sensor test installations. GRA

N81-19906# Earth Science Consulting and Technology Corp., Costa Mesa, Calif.
RADAR, THERMAL INFRARED, AND PANCHROMATIC IMAGE COLLECTION AND ANALYSIS. MULTI-SOURCE IMAGE ANALYSIS, ADDENDUM
David D. Steller, Jeffrey W. Adams, and William Muir Dec. 1980 110 p refs
(Contract DAAK70-78-C-0180)
(AD-A095169; ETL-0249-Add) Avail: NTIS HC A06/MF A01 CSCL 20/6

The addendum to the Multi-Source Image Analysis contract consists of a reference set of simultaneously collected remote sensor data designed to evaluate terrain features. Airborne radar, thermal infrared, and panchromatic imagery was collected by the Oregon Army National Guard at the Corvallis, Oregon, test site on 13 and 19 August 1980. Ground teams collected radiant and air temperatures, ground site photographs and soil samples from three traverses through the test area. GRA

N81-19907# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
A STUDY OF THE ACOUSTIC-OPTIC EFFECT IN NEMATICS Final Report, 1 Sep. 1978 - 31 Dec. 1980
Charles F. Hayes 31 Dec. 1980 193 p refs
(Contract N00014-78-C-0417)
(AD-A094782; Rept-004) Avail: NTIS HC A09/MF A01 CSCL 20/6

The program of this contract has been to study the acousto-optic effect which occurs in nematic liquid crystals when excited by acoustic waves. Both theory and practical application are presented. Hydrodynamic equations were solved which govern the streaming and obtained a solution for the magnitude of the fluid speed and flow pattern for a small disc shaped liquid crystal. A sample, doped with grains, was used to test the solution experimentally. A series of cells was constructed and tested which, in fact, showed that an acoustic wavefront pattern can be visualized with this technique. During the second year of the contract we developed and tested a mathematical model which prescribes how a cell should be constructed in terms of: the densities of the cell walls, liquid crystal, and surrounding fluids; the thickness of the cell walls and liquid crystal layer; the acoustic speeds in cell wall (shear and longitudinal), liquid crystal, and surrounding fluids; acoustic frequency; and the incident acoustic bean angle. Cells were also constructed and tested in which an electric field could be applied simultaneously with the acoustic wave in such a way that the sensitivity of the cell to the acoustic field could be adjusted. GRA

N81-19908# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
FLIR TARGET DETECTION ALGORITHMS Final Report, 1 Sep. 1979 - 31 Aug. 1980
Thomas S. Huang 30 Nov. 1980 18 p refs
(Contract DAAG29-79-C-0200)
(AD-A095152; TR-EE80-50; ARO-16948.3-A-EL) Avail: NTIS HC A02/MF A01 CSCL 17/5

The effects of noise reduction preprocessing on further analysis and classification were studied. It was found that median and linear averaging filters do help shape and texture feature extraction, however, they degrade rather than improve mensuration accuracy. The estimation of motion of rigid bodies was also studied. Based on the relation between time and spatial differences, a fundamental equation was derived which can be used to estimate the three dimensional motion parameters of rigid bodies locally. E.D.K.

N81-19909# Western Reserve Univ., Cleveland, Ohio. Case Labs. for Electrochemical Studies.
DEPOLARIZED RAYLEIGH LIGHT SCATTERING STUDIES OF CONCENTRATED AQUEOUS NITRATE SOLUTIONS
Ronald A. Carpio, Mehmed Mehicic, and Ernest Yeager 15 Dec. 1980 41 p refs
(Contract N00015-75-C-0557; NR Proj. 384-305)
(AD-A095047; TR-47) Avail: NTIS HC A03/MF A01 CSCL 07/4

Interferometric measurements of the reorientational relaxation time of the nitrate anion in concentrated aqueous calcium nitrate and zinc nitrate solutions have been made as a function of temperature and composition. Arrhenius plots of tau for Ca(NO3)2 X H2O, where X = 4, 5, and 5.6 and Zn(NO3)2 5 H2O are linear and yield activation energies in the range of 5.6 to 8.3 Kcal/mole. The data for Ca(NO3)2 3.91 H2O, which cover the most extensive range of viscosity and temperature, were non-Arrhenius and were best fitted by the Vogel-Tamman-Fulcher equation from which an ideal glass transition temperature was derived. The viscosity dependence of tau for both the Ca(NO3)2 and Zn(NO3)2 solutions was found to be between that predicted by the classical Stokes-Einstein equation and that predicted using slip hydrodynamic boundary conditions. Nitrate rotation was found to be slower in Ca(NO3)2 solutions than in the corresponding Zn(NO3)2 solutions. GRA

N81-19910# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.
OPTICAL CORRELATION SEEKER
Charles R. Christensen and Richard L. Hartman 5 May 1980 29 p refs
(AD-A094745; AD-E950083; DRSMI/RR-80-4-TR) Avail: NTIS HC A03/MF A01 CSCL 17/7

A new concept in seekers has been developed by integrating the sensor with an Optical Data Processor (ODP). The resulting system, in a terminal guidance submissile configuration, will recognize a tank if there is one in the field of view, discriminate between friend and foe, and provide guidance signals to home in on the target. The system will fit in a 150 mm diameter by 20 mm section, and consume less than one watt of power. The system will have retargeting and damage assessment capabilities. This new concept is the culmination of a number of years of research in optical data processing at the Missile Command, focusing on three main problems: real time data input, sensitivity to orientation or aspect, and size of the system. The first problem was solved by contractural development of a liquid crystal coherent image modulator, the second problem by the in-house invention of a multiplexed filter, and the third problem with the development of an ODP system which operates with a laser diode. This development opens the door to move ODP from the laboratory into Army application. GRA

N81-19911# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DEVELOPMENT AND PROPERTIES OF A SPATIAL X-RAY DETECTOR OF HIGH RESOLUTION [ENTWICKLUNG UND EIGENSCHAFTEN EINES RAEUMLICH HOCHAUFLOESENDEN ROENTGENBILDDETEKTORS]
Hans Hartmann Sep. 1979 120 p refs In GERMAN
(MPI-PAE/Extraterr-158; ISSN-0340-8922) Avail: NTIS HC A06/MF A01

A laboratory prototype of an X-ray detector with high resolution is described; it does not have a spectrum resolution, but spot resolution is ten times better (nearly 20 micrometers) than a Wolter telescope. The functions of this detector, its development and fabrication are described. The function of the wire grid detector was especially studied with regard to a further development of this detector. A mathematical model was utilized. A theory is presented for the response of the channel plates (MCP's) to soft X-rays. Author (ESA)

N81-19912# General Electric Co., Whetstone (England). Electrical Lab.
ANGULAR POSITION MEASUREMENT
C. D. Foden 1 Aug. 1979 11 p refs
(REL/TM(79)23) Avail: NTIS HC A02/MF A01

A review of angular position measurement devices is presented including potentiometers, synchros, shaft angle encoders and synchro converters. The size of synchros and encoders is discussed. The characteristics and advantages of each are listed. Author (ESA)

N81-19913# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
MONOCHROMATOR RESPONSE CALIBRATION IN THE REGION 115 TO 340 nm USING A DEUTERIUM LAMP AS A RADIANCE TRANSFER STANDARD
D. H. Nettleton Sep. 1980 26 p refs Sponsored by UK Atomic Energy Authority
(NPL-QU-60; ISSN-0309-3050) Avail: NTIS HC A03/MF A01

The calibration of the spectral response of a 1 m vacuum ultraviolet monochromator in the range 115 to 340 nm, using a deuterium lamp as a radiance transfer standard, is described. Calibrations were extended into the molecular line emission region below 165 nm using lamps fitted with magnesium fluoride windows. The calibration of a monochromator with an entrance slit of length 15 mm and with various entrance and exit slit widths is explained. Despite severe problems from contamination on the outside surface of the window, the uncertainty in the calibration is estimated as + or - 12 percent at 120 nm and + or - 8 percent at 200 nm, respectively. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-19914 Clark Univ., Worcester, Mass.
PROBLEMS IN STATISTICAL MECHANICS Ph.D. Thesis
Gentil Estevez 1980 115 p
Avail: Univ. Microfilms Order No. 8100623

A truncated virial method is used to determine the lowest order connections to the critical constants for a Lennard-Jones

system in two and three dimensions. It is found that the truncated virial method predicts a decrease of the critical temperature from its classical value in two and three dimensions. A calculation of the lowest order correction to the critical constants based on a simple modification of the Van der Waals equation yields results in qualitative agreement with the virial method. In three dimensions, the results of the truncated virial method are consistent with experimental data for the variation in the critical temperature for the noble gases. In the course of the investigation, we also obtain numerical results for the pair distribution function of first order in the density for a Lennard-Jones gas in two dimensions. The thermodynamic properties of a classical one component plasma and of systems with purely repulsive inverse power potentials are examined in the limit of high densities and low temperatures. Dissert. Abstr.

N81-19915 College of William and Mary, Williamsburg, Va.
MOST PROBABLE MAGNETOHYDROSTATIC EQUILIBRIA FOR TOKAMAKS AND REVERSED FIELD PINCHES Ph.D. Thesis
John Joseph Ambrosiano 1980 110 p
Avail: Univ. Microfilms Order No. 8103590

A statistical method is presented for determining the equilibrium of an axially symmetric cylindrical plasma which is most probable (in the maximum entropy sense) given four global constraints (i.e., energy, magnetic helicity, longitudinal magnetic flux, and longitudinal current flux). Previous results from this model are limited to nonnegative random equilibrium functions, and to analytically derived solutions of the determining equations in which one constraint (magnetic helicity) has been relaxed. These results are extended to the fully constrained problem by presenting numerically computed solutions of the governing equations. Some of these solutions are specialized to values of the constraints appropriate to Tokamaks. States which are approximately force free are shown to exist as solutions to the most probable state equations. R.C.T.

N81-19916# Nagoya Univ. (Japan).
REACTING PLASMA PROJECT AT IPP JAPAN
A. Miyahara, H. Momota, Y. Hamada, K. Kawamura (Tokyo Inst. of Technology, Ohkayama), and H. Akimune (Kyoto Univ.) Jan. 1981 54 p ref Presented at Japan-US Joint Seminar on Burning Plasma, Los Angeles, 15-17 Dec. 1980
(IPPJ-500) Avail: NTIS HC A04/MF A01

Contributed papers of a seminar on burning plasma are collected. An overview of the reacting plasma project in Japan is given and more specific topics concerning plasma and fusion physics are addressed including burning plasma and requirements for design, plasma heating and diagnostics, tritium problems in plasma experiments, and a D(-) ion source using Si-semiconductors. M.G.

N81-19917# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CHARACTERISTICS OF HOT ELECTRON RING IN A SIMPLE MAGNETIC MIRROR FIELD
M. Hosokawa and H. Ikegami Dec. 1980 19 p refs Presented at the Workshop on EBT Ring Phys., Oak Ridge, Tenn., 3-5 Dec. 1979
(IPPJ-497) Avail: NTIS HC A02/MF A01

Characteristics of hot electron ring were studied in a simple magnetic mirror machine (mirror ratio 2:1) with a diameter of 30 cm at the midplane and with the distance of 80 cm between the mirrors. Maximum microwave input power was 5 kW at 6.4 GHz with the corresponding power density of approximately 0.3 W/cu cm. With a background cold plasma of 4 x 10 to the 11th power/cu cm, hot electron rings were most effectively generated in two cases when the magnetic field on the axis of the midplane was set near the fundamental or the second harmonic electron cyclotron resonance to the applied microwave frequency. Density profile of the hot electrons was observed to take a so-called ring shape with a radius controllable by the magnetic field intensity and with an axial length of approximately 10 cm. The radial cut view of the ring, however, indicates an M shape density profile and the density of the hot electrons on the axis is about one half of the density at the ring. Approximately 30 msec is needed before generating the hot electron ring at the density of 10 the 10th power cu cm with an average kinetic energy of 100 keV. The ultimate energy distribution function was observed to have a stepwide cut in the high energy tail and no energetic components above 1 MeV were detected. R.C.T.

N81-19918# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THE XUV RADIATION TRANSFER THROUGH HIGH-Z METAL FOIL IN A LASER-PRODUCED PLASMA
J. Mizui, N. Yamaguchi, and S. Takagi (Doshisha Univ.) Dec. 1980 15 p refs
(IPPJ-498) Avail: NTIS HC A02/MF A01

An Al and an Au foil were irradiated by a 1.05 micrometers, 100 psec laser pulse at the intensity of 3 x 10 to the 14th power W/sq cm. A spatially resolved spectrum of XUV radiation from a rear side plasma was observed in the wavelength range from 10 to 100 angstroms. The spectral intensity for the Al foil decayed exponentially with the foil thickness and diminishes at 3 micrometers. That for the Au foil also decayed exponentially up to 1 micrometer but remained almost constant from 1 to 6 micrometers. This result for the Au foil indicates that radiation heat conduction plays an important role in the energy transport through high Z plasmas. R.C.T.

N81-19919# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TWIN TORI FOR A NEW BUNDLE DIVERTOR
Kazunari Ikuta Dec. 1980 11 p refs
(IPPJ-499) Avail: NTIS HC A02/MF A01

A bundle divertor system (muffler diverter) using the straight stagnation axis in the toroidal field together with the uniform field along the axis is discussed in detail. If the disruption of axisymmetry in the toroidal field for each plasma ring is not fatal, the muffler diverter could work not only to control the impurity level of hot plasma but also to remove the helium ash left by the D T reaction. M.G.

N81-19920*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC ENERGY CONVERSION (TEC) TOPPING THERMOELECTRICS
James F. Morris 1981 16 p refs Proposed for presentation at Intern. Conf. on Plasma Sci., Sante Fe, N. Mex., 18-20 May 1981; sponsored by IEEE
(Contract EC-77-A-31-1062)
(NASA-TM-81677; E-702; DOE/NASA/1062-8) Avail: NTIS HC A02/MF A01 CSCL 20I

Performance expectations for thermionic and thermoelectric energy conversion systems are reviewed. It is noted that internal radiation effects diminish thermoelectric figures of merit significantly at 1000 K and substantially at 2000 K; the effective thermal conductivity contribution of intrathermoelectric radiative dissipation increases with the third power of temperature. It is argued that a consideration of thermoelectric power generation with high temperature heat sources should include utilization of thermionic energy conversion (TEC) topping thermoelectrics. However TEC alone or TEC topping more efficient conversion systems like steam or gas turbines, combined cycles, or Stirling engines would be more desirable generally. M.G.

N81-19921*# National Aeronautics and Space Administration, Washington, D. C.
PARAMETERS AND CONTROLLING OF PLASMA CHEMISTRY
O. Tsuji Jan. 1981 15 p refs Transl. into ENGLISH from Purazuma to Kagaku (Japan), Apr. 1980 p 62-67 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by National SAMCO International Research and Development Lab., Japan
(Contract NASw-3199)
(NASA-TM-75847) Avail: NTIS HC A02/MF A01 CSCL 20I

The parameters involved in plasma polymerization reactions are examined and the use of these parameters in the control of plasma reactions is dicussed. The variables associated with the reaction chamber, electrical discharge form, frequency and electrical source for the development of plasma, and monitoring techniques are addressed. M.G.

N81-19922# Naval Research Lab., Washington, D. C. Ionospheric Effects Branch.
A PLASMA PROBE SYSTEM WITH AUTOMATIC SWEEP ADJUSTMENT Interim Report

J. C. Holmes and E. P. Szuszczewicz 23 Feb. 1981 23 p refs Sponsored in part by NOAA
(AD-A095175; NRL-MR-4424) Avail: NTIS HC A02/MF A01 CSCL 20/9

The capabilities of the pulsed Langmuir probe technique have been expanded to operate in charged particle environments having spatial and temporal variations in plasma or reference electrode potentials. This practice is implemented by logic circuitry which tracks local floating potentials and adjusts automatically the sweep center voltage to guarantee a complete current voltage characteristic with minimum sweep voltage excursion. GRA

N81-19923# California Univ., Los Angeles. School of Engineering and Applied Science.
CHAOTIC SOLUTIONS OF NONLINEAR WAVE-WAVE INTERACTING SYSTEMS IN PLASMAS Interim Report
Koshiro Masui Jun. 1980 146 p refs
(Grant AF-AFOSR-0050-79; AF Proj. 2301)
(AD-A094628; UCLA-ENG-8026; AFOSR-81-0074TR) Avail: NTIS HC A07/MF A01 CSCL 20/9

We study the chaotic behavior and phase locking in wave-wave interacting systems with linear damping or growth terms. For a two or three wave interaction, the system equations are reducible to a real three dimensional equation on a certain set, sigma, in the state space. For a three wave interaction, the phases of the waves are locked on sigma. We consider only systems of positive energy waves whose reduced equations may have chaotic behavior for almost all initial conditions. GRA

N81-19924# Naval Research Lab., Washington, D. C. Geophysical and Plasma Dynamics Branch.
PHYSICAL MECHANISM OF THE LOWER-HYBRID-DRIFT INSTABILITY IN A COLLISIONAL PLASMA Interim Report
J. D. Huba (Science Applications, Inc., McLean, Va.) and S. L. Ossakow 30 Jan. 1981 23 p refs Presented at the 6th Intern. Symp. on Equatorial Aeronomy, Aguadilla, Puerto Rico, 17-24 July 1980 Sponsored in part by DNA, Washington, D.C.
(RR0330244)
(AD-A095048; NRL-MR-4432) Avail: NTIS HC A02/MF A01 CSCL 04/1

During the past several years, high frequency radar backscatter experiments have revealed a spectrum of short wavelength (i.e., below the ion gyroradius) irregularities during equatorial spread F (ESF). Radar backscatter observations at 50 MHz, 155 MHz and 415 MHz indicate density fluctuations exist with scale sizes of 3m, 1m, and 36 cm, respectively (FARLEY et al., 1970; WOODMAN and LAHOZ, 1976; COSTA and KELLEY, 1978a,b; HUBA et al., 1978). Most recently, TSUNODA (1980) has observed radar backscatter from 11 cm (1320 MHz) irregularities during equatorial spread F at high altitudes, using the TRADEX radar. These observations were part of a coordinated Defense Nuclear Agency campaign at Kwajalein to study ionospheric irregularities during equatiorial spread F. Sharp density gradients were observed during this campaign (M. C. KELLEY, private communication, 1980) and have been observed during past equatiorial spread F events (COSTA and KELLEY, 1978a,b). The scale lengths of these gradients range from tens of meters to several hundred meters and are presumably due to primary longer wavelength instabilities such as the Rayleigh-Taylor instability. Based upon the above evidence, it has been suggested that various drift instabilities are responsible for the short wavelength irregularities (HUBA et al., 1978; COSTA and KELLEY, 1978a,b; HUBA and OSSAKOW, 1978a,b), depending upon the wavelength observed. GRA

N81-19925# Varian Associates, Palo Alto, Calif. Microwave Tube Div.
THE 60 GHz GYROTRON DEVELOPMENT PROGRAM Quarterly Report, Jul. - Sep. 1980
J. F. Shively, T. J. Grant, A. L. Nordquist, D. S. Stone, and G. E. Wendell 1980 45 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-79/21453/5; QR-5) Avail: NTIS HC A03/MF A01

A microwave oscillator capable of producing 200 kW of CW output power at 60 GHz is considered. The use of cyclotron resonance interaction is being pursued. Construction of the experimental pulsed 60 GHz gyrotron is continuing. Electron gun parts were received and a successful superconducting solenoid magnet design review was held. Coil winding began and collector construction is nearly complete. Nearly all of the window parts were received and a braze jig for the window is being machined. At present, the limiting item appears to be modification of the test set. DOE

N81-19926# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
NUMERICAL AND ANALYTICAL INVESTIGATION OF NONLINEAR PROPERTIES OF PLASMAS AND EXPERIMENTAL STUDIES OF CUSP CONFINEMENT AND OF CTR PLASMAS, THEORY PART Progress Report, 1 Sep. 1979 - 30 Apr. 1980
G. E. Knorr and N. Hershkowitz May 1980 16 p refs
(Contract DE-AC02-76ET-53034)
(DOE/ET-53034/62) Avail: NTIS HC A02/MF A01

Several theoretical investigations are briefly summarized. Turbulence theory, plasma drift, and nonlinear properties of plasmas are addressed. DOE

N81-19927# Los Alamos Scientific Lab., N. Mex.
FINITE ION LARMOR RADIUS EFFECTS AND WALL EFFECTS ON m = 1 INSTABILITIES
Thomas E. Cayton Dec. 1980 20 p refs
(Contract W-7405-eng-36)
(LA-8650-MS) Avail: NTIS HC A02/MF A01

A set of fluid-like equations that simultaneously includes effects due to geometry and finite ion gyroradii is used to examine the stability of a straight, radially diffuse screw pinch in the regime where the poloidal magnetic field is very small compared with the axial magnetic field. It is shown that this pinch may be rendered completely stable through a combination of finite Larmor radius effects and wall effects. Many of the m = 1 modes of the diffuse pinch can be stabilized by finite ion Larmor special nature of the m = 1 eigenfunctions, finite ion gyroradius effects are negligible for the kink modes of very large wavelength. This special nature of the eigenfunctions, however, makes these modes good candidates for wall stabilization. The finite Larmor radius stabilization of m = 1 modes of a diffuse pinch is contrary to the conventional wisdom that has evolved from studies of sharp boundary, skin current models of the pinch. DOE

N81-19928# Oak Ridge National Lab., Tenn.
DESTABILIZATION OF LOW MODE NUMBER ALFVEN MODES IN A TOKAMAK ENERGETIC OR ALPHA PARTICLES
K. T. Tsang, D. J. Sigmar, and J. C. Whitson Dec. 1980 40 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7508) Avail: NTIS HC A03/MF A01

With the inclusion of finite Larmor radius effects in the shear Alfven eigenmode equation, the continuous Alfven spectrum is removed. Neutrally stable, discrete radial eigenmodes appear in the absence of sources of free energy and dissipation. Alpha (or energetic) particle toroidal drifts destabilize these modes, provided the particles are faster than the Alfven speed. Although the electron Landu resonance contributes to damping, a stability study of the parametric variation of the energy and the density scale length of the energetic particles shows that modes with low radial mode numbers remain unstable in most cases. Since the alpha particles are concentrated in the center of the plasma, this drift-type instability suggests anomalous helium ash diffusion. It is shown that stochasticity of alpha orbits due to the overlapping of radially neighboring alfven resonances is induced at low amplitudes, e sub i phi/T sub i greater than or equal to 0.05, implying a diffusion coefficient d sub r (ALPHA) greater than or equal to 4.4 x 1000 sq cm/s. DOE

N81-19929# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR FUSION Quarterly Report, Jan. - Mar. 1980
M. A. Harrison, ed. and C. K. McGregor, ed. 25 Jul. 1980 87 p refs
(Contract W-7405-eng-48)
(UCAR-10060-80-1) Avail: NTIS HC A05/MF A01

Progress reported in the mirror fusion energy program covers (1) fusion, plasma theory, and computation; (2) magnetic mirror system and tandem mirror experiments; (3) superconducting magnetic development; (4) fusion reactor materials; (5) experiments in the mirror fusion test facility; and (6) design and construction of the facility. Topics covered include fiber optic communication links; desorption of deuterium and contaminants; neutral beam injection; operating point for the Yin-Yang cell; and reverse field pinch. A.R.H.

N81-19930# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY AND TECHNOLOGY REVIEW
Dec. 1980 38 p refs
(Contract W-7405-eng-48)
(UCRL-52000-80-12) Avail: NTIS HC A03/MF A01

Topics discussed include: (1) the Nova laser fusion facility; (2) computer modeling of magnetic mirror experiments, and (3) mirror fusion test facility supervisory control systems. DOE

N81-19931# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
STUDY OF ION LINE BROADENING IN THE TORMAC DISCHARGE Ph.D. Thesis
Robert Stephen Shaw Jul. 1980 197 p refs
(Contract W-7405-eng-48)
(LBL-10748) Avail: NTIS HC A09/MF A01

Tormac (Toroidal Magnetic Cusp) is a magnetic confinement plasma concept having absolute minimum B geometry. Two versions of Tormac are considered here. Tormac T IV-c has a glass vessel of rectangular cross section, 0.5 m in diameter. The confinement field rises to approx. 4.5 kG in approx. 8.3 micro sec. Tormac T V has a T shaped glass vessel, 1 m in diameter, with a field of approx. 3 kG, rising in approx. 10 micro sec. Gaussian HeII 4686 angstrom spectral lines having full widths at half maximum over 2 angstrom have been observed in both Tormac plasmas. DOE

N81-19932# Argonne National Lab., Ill. Engineering Div.
TWO-DIMENSIONAL MHD GENERATOR MODEL
H. K. Geyer, R. K. Ahluwalia, and E. D. Doss Sep. 1980 103 p refs
(Contract W-31-109-eng-38)
(ANL/MHD-80-11) Avail: NTIS HC A06/MF A01

A steady state, two dimensional MHD generator code, GEN, is presented. The code solves the equations of conservation of mass, momentum, and energy, using a Von Mises transformation and a local linearization of the equations. By splitting the source terms into a part proportional to the axial pressure gradient and a part independent of the gradient, the pressure distribution along the channel is easily obtained to satisfy various criteria. Thus, the code can run effectively in both design modes, where the channel geometry is determined, and analysis modes, where the geometry is previously known. The code also employs a mixing length concept for turbulent flows, Cebeci and Chang's wall roughness model, and an extension of that model to the effective thermal diffusivities. Results on code validation, as well as comparisons of skin friction and Stanton number calculations with experimental results, are presented. DOE

N81-19933# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
GENERALIZED GYROKINETICS
P. J. Catto, W. M. Tang (Princeton Univ., New Jersey), and D. E. Baldwin Oct. 1980 21 p refs Prepared in cooperation with Calif Univ., Lawrence Livermore Lab.
(Contracts DE-AC03-76ET-53057; W-7405-eng-48; EY-76-C-02-3497)
(SAI-254-80-566-LJ; PR1-14) Avail: NTIS HC A02/MF A01

By retaining the magnetic moment (MU) to higher order in the gyroradius over scale length expansion and employing a gyrokinetic change of variables, a full finite beta derivation of the gyrokinetic equation is presented within the eikonal ansatz for arbitrary magnetic fields and (MU) dependent unperturbed distribution functions. DOE

N81-19934# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
FINITE-LARMOR-RADIUS STABILIZATION OF BALLOONING MODES IN AN AXISYMMETRIC TANDEM MIRROR
D. A. Dippolito, G. L. Francis, J. R. Myra, and W. M. Tang Nov. 1980 15 p refs
(Contract DE-AC03-79-53057)
(SAI-254-80-633-LJ; PR1-18) Avail: NTIS HC A02/MF A01

The stability of an axisymmetric tandem mirror to ballooning modes is examined including the effect of finite ion gyroradium stabilization. The central cell of the tandem mirror is treated as a long thin system with isotropic pressure, while the end plug is modeled by a stabilizing boundary condition. For the particular equilibrium considered, the finite-Larmor radius corrections to the ideal magnetohydrodynamic theory indicate a strong stabilizing effect on high-n ballooning modes even for quite modest values of gyroradius, k/sub perpendicular to/rho/sub i/ approx. a/L much less than 1. The dependence of (BETA)/sub c/ on k/sub perpendicular to/rho/sub i/ is computed and possible physical mechanisms associated with this stabilizing influence are discussed. DOE

N81-19935# Wisconsin Univ. - Madison. Dept. of Nuclear Engineering.
TANDEM MIRROR SLOSHING-ELECTRON PLUGS
J. Kesner Apr. 1980 15 p refs Prepared in cooperation with MIT, Cambridge
(Contract DE-AS02-78ET-52048)
(UWFDM-349) Avail: NTIS HC A02/MF A01

By a proper usage of ECRH heating in minimum-B tandem mirror plugs thermal barriers can be created which thermally insulate hot plug electrons from both the central cell and the outside environment. This arrangment was utilized in an axisymmetric arrangement ICRF served as a pump for preventing ions from accumulating in the thermal barrier potential depression whereas in the minimum-B plug unconfined drift orbits prevented such an accumulation. DOE

N81-19936# TRW Defense and Space Systems Group, Redondo Beach, Calif.
LASER/PLASMA THEORY FOR MICROWAVE MODELING EXPERIMENTS Final Report
J. J. Thomson and W. F. Divergilio 1980 36 p refs
(Contract DE-AC08-79DP-40116)
(DOE/DP-40116/1) Avail: NTIS HC A03/MF A01

During the last year, we have carried out theoretical investigations of microwave plasma interactions in support of both the UCLA program and the TRW program. The UCLA program concentrated on experimental studies of Stimulated Brillouin Scattering (SBS). We derived a theory which successfully explained the basic features of their experiment. The TRW program was originally conceived of as an investigation of electron heating and thermal transport; however, the subject was later changed to the interaction of SBS and self focusing. The experimental program has not yet started; however, we have developed a theoretical description of the expected interaction. DOE

N81-19937# Paris-Sud Univ., Orsay (France). Lab. de Physique des Plasmas.
THEORETICAL MODEL OF A PLASMA GENERATED BY A SURFACE WAVE
P. Leprince, J. Marec, V. M. Glaude (Montreal Univ.), M. Moisan (Montreal Univ.), and R. Pantel (Montreal Univ.) Feb. 1980 9 p refs
(LP-178) Avail: NTIS HC A02/MF A01

A theoretical model is offered which describes the characteristics of plasma columns generated by surface waves. Linearized equations are presented describing propagation, collisional energy transfer, and total number of created electrons. The density and energy distributions along the plasma columns are numerically obtained. It is shown that the longitudinal density gradient is proportional to the collision frequency, and also that for an initial given density, the necessary incident power and the plasma length can be calculated. Experimental and numerical results are compared and good agreement is found. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-19938 Purdue Univ., Lafayette, Ind.
HIGH RESOLUTION STUDIES OF THE EXCITATION SPECTRA OF DONORS IN SILICON WITH AND WITHOUT UNIAXIAL STRESS Ph.D. Thesis
Chirravuri Jagannath 1980 196 p
Avail: Univ. Microfilms Order No. 8102670

The excitation spectra of phosphorus, arsenic isolated interstitial lithium, and lithium oxygen donors in Si were investigated with and without uniaxial stress under the high resolution (0.06 cm) of a Fourier transform spectrometer. Listing a strain free mounting technique, the true line widths were observed to be much narrower than those reported earlier. An ingenious technique of introducing phosphorus in silicon was based on the nuclear transmutation of Si 30 into P-31 by the capture of a slow neutron followed by Beta decay. The line widths and shapes as affected by the presence of charged defects produced by neutron irradiation were studied. An explanation for the observed line width and shape was proposed in terms of the electric fields due to charged impurities and defects.
Dissert. Abstr.

N81-19939 Cornell Univ., Ithaca, N. Y.
DISLOCATION STRUCTURES IN HIGH ANGLE [001] TWIST BOUNDARIES IN MAGNESIUM OXIDE Ph.D. Thesis
Chung-Ping Sun 1980 193 p
Avail: Univ. Microfilms Order No. 8103001

A systematic transmission electron microscope (TEM) investigation of possible secondary grain boundary dislocation (GBD) structures in [001] high angle twist boundaries in MgO was carried out using bicrystals of controlled geometry. Techniques were developed to fabricate an extensive series of MgO bicrystals containing 001 twist boundaries with twist angle, theta, covering the entire possible range, 0 < theta less than or equal to 45 deg. Tables of MgO single crystals with cleaved 100 faces were welded together by hot pressing. The TEM specimens were prepared by a combination of mechanical and chemical jet polishing using phosphoric acid. Weak beam microscopy was used extensively since this technique is capable of producing a characteristic narrow defect image width, and hence allows complicated GBD networks to be resolved more readily than by use of conventional microscopy.
Dissert. Abstr.

N81-19940 Cornell Univ., Ithaca, N. Y.
HAMILTONIAN STUDIES OF PHASE DIAGRAMS OF LATTICE GAUGE THEORIES AND SPIN SYSTEMS Ph.D. Thesis
Jay Lewis Banks 1980 94 p
Avail: Univ. Microfilms Order No. 8102981

Hamiltonian lattice methods are used to study gauge theories with discrete symmetries coupled to scalar fields, and magnetic systems with continuous symmetries. After the general method is introduced and applied to the Z2 pure gauge theory as an example, it is employed in an analysis of the phase diagram of the same theory coupled to Higgs fields, in 2 + 1 dimensions. Strong coupling expansions and Pade approximants are used to find zeros of the mass gap in the latter theory, which indicate second order phase transitions. The results are qualitatively in agreement with what is expected from arguments based on the partition function formulation of the theory. First order transitions, which are found by other methods, are also discussed for similar theories, in the context of a (1/N) expansion.
Dissert. Abstr.

N81-19941 Kent State Univ., Ohio.
NUCLEAR MAGNETIC RESONANCE STUDIES OF ORIENTATIONAL ORDER IN LYOTROPIC LIQUID CRYSTALS Ph.D. Thesis
Nuno A. P. Vaz 1980 222 p
Avail: Univ. Microfilms Order No. 8100698

The motionally averaged deuteron quadrupole interaction was measured as perturbation on the Zeeman interaction in samples, containing either per-deuterated or methyl-deuterated potessium palmitate. Using a model based approach, the data were related to parameters which describe properties of the orientational order of either the molecule as a whole or of the individual molecular segments relative to a common molecular frame. From the analysis of the data, several conclusions are drawn: (1) the lamellar L region is found to be actually polymorphic, (2) the average conformation of the lipid hydrocarbon chain is shown to be essentially temperature indepedent and fluctuations in the conformation of the molecule are shown, not to by cylindrically symmetric; and (3) biaxiality was detected in the orientational order of the hydrocarbon chain near the transition from the lamellar (alpha) region to the gel phase.
Dissert. Abstr.

N81-19942 Iowa State Univ. of Science and Technology, Ames.
LATTICE DYNAMICS IN THE ALPHA-PHASE OF THE IVB TRANSITION ELEMENTS Ph.D. Thesis
David Kevin Arch 1980 212 p
Avail: Univ. Microfilms Order No. 8103428

Inelastic neutron scattering techniques were used to study the temperature dependent lattice dynamics of titanium and hafnium in the hep (alpha) phase. The dispersion curves as well as their temperature dependence were investigated in order to obtain information about the temperature dependence of the thermophysical properties of these elements as well as the change with temperature of the electronic response to the nuclear motions. The results show a significant softening of the phonon modes as the temperature is increased for all branches of the dispersion curves except the [001]LO zone-center mode. This mode increase in frequency with increasing temperature. These features of the dispersion curves if both metals bear a striking resemblance to zirconium. The lattice specific heat at constant pressure was evaluated as a function of temperature. The unusual temperature dependence of the LO[001] zone center mode and the large decrease in the frequencies of the other model with increasing temperature for the IVB elements is explained on the basis of their unique electronic structure near the Fermi surface.
Dissert. Abstr.

N81-19943 Houston Univ., Tex.
HYDROGEN EMBRITTLEMENT IN SINGLE- AND POLY-CRYSTAL NIOBIUM Ph.D. Thesis
Mohammad M. Farahani 1980 111 p
Avail: Univ. Microfilms Order No. 8103739

The effect of dissolved hydrogen on the yielding and the ductility of both poly- and single-crystal niobium was studied in the temperature range between 78 and 373 K. Tensile tests were carried out on niobium specimens containing hydrogen ranging between 30 and 230 ppm wt., at a strain rate of 1.7 x 10 to the -4 power/sec. The fracture surfaces of specimens tested were also examined by means of a scanning electron microscope (S.E.M.). Analysis of the results obtained suggests the presence of two distinct mechanisms responsible for the embrittlement of niobium by hydrogen. One mechanism is operative at the onset of embrittlement, and is sensitive to the presence of grain boundaries. This mechanism appears to be of decohesion nature, where the presence of hydrogen facilitates the nucleation and the propagation of cracks. The second mechanism predominates at temperatures of the second ductile-brittle transition and is associated with the precipitation of the brittle hydride phase. The latter mechanism is found to have similar effects on both single- and polycrystals
Dissert. Abstr.

N81-19944*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ELECTROMIGRATION PROCESS FOR THE PURIFICATION OF MOLTEN SILICON DURING CRYSTAL GROWTH Patent Application
Paul J. Shlichta, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 10 Feb. 1981 15 p
(Contract NAS7-100)
(NASA-Case-NPO-14831-1; US-Patent-Appl-SN-233269) Avail: NTIS HC A02/MF A01 CSCL 20B

A process for the purification of molten materials during crystal growth by electromigration of impurities to localized dirty zones has particular applications for silicon crystal growth according to Czochralski techniques and edge defined film fed

growth (EFG) conditions. In the Czochralski crystal growing process, the impurities are electromigrated away from the crystallization interface by applying a direct electrical current to the molten silicon for electromigrating the charged impurities away from the crystal growth interface. In the EFG crystal growth process, a direct electrical current is applied between the two faces which are used in forming the molten silicon into a ribbon. The impurities are thereby migrated to one side only of the crystal ribbon. The impurities may be removed or left in place. If left in place, they will not adversly affect the ribbon when used in solar collectors. The migration of the impurity to one side only of the silicon ribbon is especially suitable for use with asymmetric dies which preferentially crystallize uncharged impurities along one side or face of the ribbon. NASA

N81-19945# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
INTERPRETATION OF THE STRIATION OF RUBY CRYSTALS
G. Nitschmann and A. Gregory (Frankfurt Univ.) 1981 9 p refs Transl. into ENGLISH from Zeitschrift fuer Physik Chem. Neue Folge, (West Germany), no. 121, 1980 p 237-242
(NRC/CNR-TT-1996; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The occurrence of periodic color changes in laser grown ruby crystals is examined. The crystals were grown using the method of floating zone melting; the floating zone being produced by beams from CO2 lasers. Cathode luminescence showed the same striations due to differences in Cr content. As the value of the distribution coefficient of Cr in Al2O3 is practically unity, fluctuations in the temperature of the molten zone and the resulting changes in growth rate should not influence the Cr distribution. It is found that the content of dissolved gas in the melt is the reason for the luminescence fluctuations and color striations. M.G.

N81-19946# Cambridge Univ. (England). Dept. of Physics.
CARRIER LOCALISATION IN INVERSION LAYERS AND IMPURITY BANDS Annual Technical Report, Sep. - Nov. 1980
M. Pepper Nov. 1980 32 p refs
(Grant DA-ERO-78-G-098; DA Proj. 1T1-61102-BH-57)
(AD-A094887) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report contains results on the ballistic injection of electrons between Al and N&Si and Al and the Si inversion layer. This was the first experiment on ballistic injection between a semiconductor and a metal, and yielded results of considerably greater clarity than those found from the all metal work. Basically the phonons responsible for intervalley scattering can be clearly observed and the technique offers a means of identifying the various subbands in the Si inversion layer. Plasmons could be observed and in future it is planned to extend this technique to III-V semiconductors. The other area of research described in this report is a collaborative experiment with Dr. K. von Klitzing and Dr. G. Dorda. It is shown that the Hall resistance of a MOSFET, when the conduction band is quantized by a strong magnetic field, is related simply to the fine structure constant. The experiment is described in detail. GRA

N81-19947# Frequency Electronics, Inc., New Hyde Park, N.Y.
VIBRATION RESISTANT QUARTZ CRYSTAL RESONATORS Interim Report, 28 Feb. - 27 Aug. 1980
B. Goldfrank and A. Warner Jan. 1981 110 p refs
(Contract DAAK20-79-C-0272; DA Proj. 1L1-62705-AH-94)
(AD-A094682; DELET-TR-79-0272-2; IR-2) Avail: NTIS HC A06/MF A01 CSCL 09/1

The objectives of this investigation are to provide doubly rotated quartz crystal resonators that exhibit fast warm-up and low 'g' sensitivity. Warm-up is to be on the order of 1 PP 10 to the 9th power in three minutes. The 'g' sensitivity is to be 1 PP 10 to the 10th power maximum in any axis. GRA

N81-19948# Hughes Research Labs., Malibu, Calif.
INFRARED PROPERTIES OF HIGHLY TRANSPARENT SOLIDS Final Report, 1 Jul. 1978 - 1 Jul. 1980
Morris Braunstein 1 Jul. 1980 8 p
(Contract F49620-78-C-0094; AF Proj. 2306)
(AD-A094780; AFOSR-81-0094TR) Avail: NTIS HC A02/MF A01 CSCL 20/2

The optical properties of highly transparent single crystals of KBr, KCl, CaF2 and BaF2 have been measured using laser calorimetric techniques and wavelength modulation spectroscopy techniques in the spectral range for 2.5 to 12 microns in cooperation with the University of California at Los Angeles (UCLA). Rich and varied absorption structures in the spectra were observed in all of the crystals enabling an identification of volume and surface absorption. Similar dominant bands are observed in many of the crystals indicating the presence of common impurities regardless of the crystal and origin of its growth. However, varied fine structure was observed in different crystals which are indicative of the individual characteristics of the chemistry of the crystal preparation. The measurements were performed in laboratory and dry nitrogen ambients and the physical absorption and desorption of surface contaminants was readily observed. Ellipsometric techniques were developed to evaluate and measure the strain and anisotropy in infrared optical films. Improved Reactive Atmosphere Processing (RAP) techniques were developed and studied using a two zone RAP furnace for single crystal growth of BaF2 and CaF2 which resulted in improved infrared transmission in the 3 to 5 micron wavelength region for the first time. GRA

N81-19949# National Bureau of Standards, Washington, D.C. Surface Science Div.
THE USE OF ANGLE-RESOLVED ELECTRON AND PHOTON STIMULATED DESORPTION FOR SURFACE STRUCTURAL STUDIES
Theodore E. Madey 1 Feb. 1981 27 p refs
(Contract N00014-81-F-0021)
(AD-A095136; TR-12) Avail: NTIS HC A03/MF A01 CSCL 07/4

We review recent experiments and models related to desorption processes induced by electrons and photons incident on surfaces. The utility of angle resolved electron and photon stimulated desorption of ions for studies of molecular structure at surfaces is emphasized. GRA

N81-19950# Northeastern Univ., Boston, Mass.
PHONON SELF-ENERGIES IN WEAKLY AND STRONGLY ANHARMONIC SYSTEMS Final Report, Jun. 1975 - Dec. 1980
Robert P. Lowndes 11 Dec. 1980 100 p
(Grants DA-ARO(D)31-124-72-G125; DAHC04-75-G-0166)
(AD-A095151; ARO-10392.14-P; ARO-12918.10-P)
Avail: NTIS HC A05/MF A01 CSCL 20/12

The interatomic forces in a crystal are usually strongly dependent on the interatomic spacing and consequently the lattice potential energy for a crystal can generally be written as a power series in the displacements of the atoms from their equilibrium positions. If such an expansion is terminated at the quadratic terms, then this constitutes the so-called harmonic approximation. In the harmonic approximation the lattice vibrations are true normal modes such that if energy is channeled uniquely into any one lattice mode, then it will remain undissipated in that mode. The harmonic approximation would therefore predict, for instance, that the scattering cross section for neutrons by a Bravais lattice would consist of a set of δ function peaks or, analogously, that the spectral profiles of lattice vibrations would be a set of undamped temperature independent resonances. These and other such predictions are, of course, in marked discord with experimental results. It is therefore clear that the anharmonic terms in a lattice potential must be considered if a full understanding of many of the physical properties of solids is to be achieved. GRA

N81-19951# Illinois Univ., Urbana. School of Chemical Sciences.
EXCITED STATE ELECTRON TRANSFER IN SYSTEMS WITH A WELL-DEFINED GEOMETRY Progress Report, 1 May 1980 - 30 Apr. 1981
K. J. Kaufmann Dec. 1980 10 p refs
(Contract DE-AC02-79ER-10392)
(DOE/ER-10392/3) Avail: NTIS HC A02/MF A01

The effect of temperature, dielectric strength and ligand on the structure of the mesopyropheophorbide cyclophanes was studied. Electron spin resonance, nuclear magnetic resonance

emission and absorption spectroscopy, as well as circular dichroism were used. The changes in structure correlated with changes in the photochemical activity. Electron acceptors such as benzoquinone were utilized to stabilize the charge separation. Charge separation in porphyrin quinone dimers were also studied. It was found that electron transfer in the cyclophane system is relatively slow. This is presumably due to an orientation requirement for fast electron transfer. Solvent dielectric also is important in producing a charge separation. Decreasing the temperature affects the yield of charge transfer, but not the kinetics. DOE

N81-19952# Washington Univ., St. Louis, Mo. Dept. of Physics.
DETERMINATIONS OF LATTICE AND ELECTRONIC STRUCTURES OF SOLIDS BY ELECTRON SCATTERING
Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Patrick C. Gibbons 1980 14 p refs
(Contract DE-AS02-79ER-10440)
(DOE/ER-10440/1) Avail: NTIS HC A02/MF A01

The development of an electron scattering technique for determining the lattice and electronic structure of solids is discussed. Techniques and facilities for sample characterization, data gathering, and data analysis are briefly described. Operation of the electron microscope and the electron detector, and ray tracing analysis of the spectrometer, produced results sufficient to allow a refined estimate of the system's performance. DOE

N81-19953# Electricity Council Research Centre, Capenhurst (England).
COMPUTER-AIDED PREPARATION OF PREFERRED ORIENTATION POLE FIGURES
A. D. Cross and E. H. Kelly Feb. 1979 25 p refs Original contains color illustrations
(ECRC/M1223; Job-601) Avail: NTIS HC A02/MF A01

A combination of standard X-ray equipment and computer programming which permits the routine preparation of pole figures is described. A map of the distribution of the normals to given crystallographic planes of polycrystalline specimens was prepared using standard X-ray equipment and data processing by an off-line computer. Several examples are presented. Author (ESA)

N81-19954# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.
CALCULATION OF SHOCK POLARS FOR A SUBSTANCE WITH A COMPACT ISOTROPIC STRUCTURE USING THE MORSE POTENTIAL [CALCUL DES POLAIRES DE CHOC DE CORPS A STRUCTURE ISOTROPE COMPACTE A L'AIDE DU POTENTIEL DE MORSE]
Puech and Sakowitsch 20 Nov. 1979 22 p refs In FRENCH Presented at 7th Intern. Conf. AIRAPT sur les Hautes Pressions, Le Creusot, France, 31 Jul. - 3 Aug. 1979
(SNIAS-801-422-102) Avail: NTIS HC A02/MF A01

Two characteristic constants (sublimation energy and the speed of sound at zero pressure) are used to calculate shock polars and coefficients. Values corresponding to a series of substances (Al, Cu, Ni, W, Pb, Zn, Ag, Mg, Ta) are given together with some specific application (graphite, tatalum carbide and germanium). The calculations also enable the density and speed of sound at zero pressure to be obtained for the metastable phase of a substance exhibiting a phase change when subjected to pressure. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N81-19955# Princeton Univ., N. J. Dept. of Physics.
SOME GENERAL THOUGHTS ABOUT BROKEN SYMMETRY
P. W. Anderson 21 Jan. 1981 29 p refs Presented at the Colloq. Pierre Curie, Paris, 1 Sep. 1980 Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N.J.
(Contract N00014-77-C-0711; Grant NSF DMR-78-03015; NR Proj. 318-058)
(AD-A094870) Avail: NTIS HC A03/MF A01 CSCL 20/13

Broken symmetry is precisely defined and the phenomena associated with it are characterized. The extent to which generalization to random systems and to dissipative structures may be made is examined. Thermal equilibrium broken symmetry is characterized by an order parameter ETA (R) which is a thermodynamic variable with a physical conjugate force field X, and by a free energy which is dependent on ETA(R). From these properties follow not only the Landau thermodynamics, but also the phenomena of generalized rigidity, Goldstone collective excitations, and topologically staple defects. Possible consequences of relaxing these assumptions are explored. GRA

N81-19956# Princeton Univ., N. J. Dept. of Physics.
THE THOULESS CONJECTURE FOR A ONE-DIMENSIONAL CHAIN
P. W. Anderson and P. A. Lee 21 Jan. 1981 14 p refs Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N.J.
(Contract N00014-77-C-0771; Grant NSF DMR-78-03015; NR Proj. 318-058)
(AD-A094966) Avail: NTIS HC A02/MF A01 CSCL 20/10

The Thouless conjecture relating energy level shifts as a function of boundary conditions to conductance is shown to be incorrect in detail in the one dimensional chain, though qualitatively correct: the dimensionless conductances defined by scattering theory and by Thouless' conjecture are functions of each other. GRA

N81-19957# Los Alamos Scientific Lab., N. Mex.
THERMODYNAMIC PROPERTIES OF FLUID (4)He IN THE 75 TO 300 K AND 2- TO 20-KBAR RANGE
D. H. Liebenberg, R. L. Mills, and J. C. Bronson Oct. 1980 31 p refs
(Contract W-7405-eng-36)
(LA-8250-MS) Avail: NTIS HC A03/MF A01

Pressure, volume, temperature, and sound velocity measurements of He-4 on (4)He in the ranges 75 to 300 (0)K and 2 to 20 kbar are presented. From an equation of state fitted to these data, the thermodynamic quantities: volume, sound velocity, thermal expansivity, heat capacity at constant pressure, the ratio of specific heats, adiabatic compressibility, and molar entropy are calculated and tabulated. Computer-drawn graphs of the isothermal pressure variation of these quantities are presented and the precision of the fits to the data is discussed. Comparison with other measurements is described in the limited region of overlap, that is, at less than 10 kbar and near room temperature. DOE

N81-19958# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
HIGH TEMPERATURE EXPANSIONS FOR THE FREE ENERGY OF VORTICES RESPECTIVELY THE STRING TENSION IN LATTICE GAUGE THEORIES
Gernot Muenster May 1980 32 p refs
(PB81-115008; DESY-80/44) Avail: NTIS HC A03/MF A01 CSCL 20J

High temperature cluster expansions are derived for the free energy of vortices in SU(2) and Z2 lattice gauge theories in 3 and 4 dimensions. The expected behavior of the vortex free energy is verified. It obeys an area law behavior. The coefficient of the area is shown to be equal to the string tension between static quarks. Its expansion is calculated up to the 12th order. For SU(2) in 4 dimensions, the result is compared with Monte Carlo calculations of Creutz and is in good agreement at strong and intermediate coupling. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-19959*# National Aeronautics and Space Administration, Washington, D. C.

RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS SUMMARY FY81

1981 158 p

(NASA-TM-82189) Avail: NTIS HC A08/MF A01 CSCL 05A

A compilation of the summary portions of each of the Research and Technology Operating Plants (RTOP) used for management review and control of research currently in progress throughout NASA is presented. Indexes include: subject, technical monitor, responsible NASA organization, and RTOP number.

Facility (A.R.H.)

N81-19960# Decisions and Designs, Inc., McLean, Va.

RSCREEN AND OPGEN: TWO PROBLEM STRUCTURING *DECISION AIDS WHICH EMPLOY DECISION TEMPLATES*

Jonathan J. Weiss and Clinton W. Kelly, III Oct. 1980 120 p refs

(Contract N00014-79-C-0068; DARPA Order 3668)

(AD-A094784; TR-80-4-97) Avail: NTIS HC A06/MF A01 CSCL 05/10

Decision templates are prestructured procedural aids for evaluating various alternative courses of action available to a decision maker. This report describes two computer based decision *aids which are structured using decision analytic methodology.* The first aid, RSCREEN (Rapid SCREENing of decision options), is an interactive computer software program that assists decision makers in a crisis situation characterized by severe constraints on time, detailed information processing procedures, and training in evaluating several different courses of action. Each decision template in the RSCREEN aid encompasses the critical elements of the political-military situation in much the same manner as a well developed contingency plan. For example, if a decision maker is faced with the immediate evacuation of diplomatic personnel from a hostile foreign country, he/she can draw on the RSCREEN aid for relevant data on evacuation procedures in general and to assess his/her particular problem in light of these previous evacuation procedures. GRA

N81-19961# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A COMPUTATIONALLY EFFICIENT HEURISTIC FOR A TWO-ECHELON, TWO-INDENTURE INVENTORY MODEL M.S. Thesis

William H. Hughes, Jr. Dec. 1980 128 p refs

(AD-A095113; AFIT/GOR/OS/80D-4) Avail: NTIS HC A07/MF A01 CSCL 15/5

This project addresses the computational difficulties of MOD-METRIC, a two-echelon, two-indenture recoverable item inventory model which is used by the Air Force Logistics Command *(AFLC). As background, the theoretical development and current* solution technique of MOD-METRIC are presented. After identifying the major causes of the computational difficulties, a *different approach to solving the MOD-METRIC problem,* based on recent work by Kotkin and Muckstadt, is presented. The final form of the efficient heuristic proposed in this project *incorporates a new estimation procedure for the important* parameters of this heuristic, and also includes an expanded search over those parameters. The results of comparing heuristic solutions with solutions obtained using the current MOD-METRIC system indicate that the heuristic provides solutions that are very close to optimal at a greatly reduced computational cost for a variety of MOD-METRIC problems. An additional benefit of the heuristic is that it generates many more solutions in a single computer run than does the current system. It is recommended that users of the current MOD-METRIC system use the implemented heuristic, after gaining confidence in its accuracy. Additionally, it *is hoped that this efficient heuristic will provide an incentive for* AFLC to incorporate a two-indenture model into the AFLC recoverable item inventory management system. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see 61 *Computer Programming and Software.*

N81-19962* National Aeronautics and Space Administration, Washington, D. C.

NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 18, JANUARY 1981

Jan. 1981 50 p

(NASA-SP-7039(18)) Avail: NTIS HC $8.50 CSCL 05B

Abstracts are cited for 120 patents and patent applications for patents introduced into the NASA scientific system during *the period of July 1980 through December 1980. Each entry* consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent.

M.G.

N81-19963* National Aeronautics and Space Administration, *Washington, D. C.*

NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES

Jan. 1981 726 p

(NASA-SP-7039(18)) Avail: NTIS HC $12.50 CSCL 05B

Entries for 3900 patents and patent applications citations *for the period May 1980 through December 1980* are listed. Indexes for subject, invention, source, number, and accession number are included. J.M.S.

N81-19964*# National Aeronautics and Space Administration, *Langley Research Center, Hampton, Va.*

SCIENTIFIC AND TECHNICAL INFORMATION OUTPUT OF THE LANGLEY RESEARCH CENTER, FOR CALENDAR YEAR 1976

1976 123 p refs

(NASA-TM-82310) Avail: NTIS HC A06/MF A01 CSCL 05B

Documents listed include NASA Technical Reports, Technical Notes, Technical Memorandums, Special Publications, Contractor *Reports, journal articles, and technical presentations made at* Society meetings. NASA formal reports listed are those that were mailed and distributed to the ultimate user. The material *presented here is listed first by Division and then under the* following headings: (a) Formal Reports, (b) Contractor Reports, (c) Articles and Meeting Presentations, and (d) High Number *Technical Memorandums (High TMX's). Under each heading, the* material cited authors in alphabetical order. If a report has more than one author and these authors are from different Divisions, *the report is listed only once, under the senior author's name.*

A.R.H.

N81-19965# Naval Research Lab., Washington, D. C. Technical Information Div.

RECORDS SYSTEMS OF THE NAVAL RESEARCH LABORATORY: CENTRAL RECORDS AND DIRECTIVES SYSTEM RECORDS

D. K. Allison 24 Feb. 1981 63 p

(AD-A095178; NRL-MR-4464) Avail: NTIS HC A04/MF A01 CSCL 05/2

This report results from the first phase of a comprehensive study of all archival records systems of the Naval Research Laboratory. The report describes two major archival collections:

the central records of the Laboratory, which are managed by the Records and Correspondence Management Branch, and the records of NRL Directives--official policy declarations--which are managed by the Administrative Management Section. The aim of the report is to explain what constitutes the collections, how they are organized, and how they may best be used. GRA

N81-19966# Corps of Engineers, Seattle, Wash.
IN-HOUSE INFORMATION SYSTEM (IHIS) STUDY/PROJECT REPORT Final Report, Nov. 1978 - Mar. 1980
Ellen M. Traxel, Mary K. Pritchard, and Nancy E. Taghon Oct. 1980 25 p
(AD-A095101) Avail: NTIS HC A02/MF A01 CSCL 05/2

Lack of a systematic information policy in the Seattle District Army Corps of Engineers resulted in inefficient use of internal information and staff time. After the problem was analyzed by the District's library staff, an in-house computerized information storage and retrieval system was tested. A sample of in-house reports was indexed and input into the local Harris computer utilizing FAMULUS software. The final analysis of the sample determined that the FAMULUS software was insufficient to manipulate the large file. The study team recommended that the purchase of large file, bibliographic oriented software be made to allow a larger file size and more sophisticated searching capabilities. GRA

N81-19967# Pittsburgh Univ., Pa. Learning Research and Development Center.
RETRIEVING INFORMATION ABOUT LOCATIONS
James G. Greeno, Maria E. Magone, Alexander W. Siegel, and James J. Mokwa 26 Jan. 1981 44 p refs
(Contract N00014-78-C-0022)
(AD-A095137; TR-6) Avail: NTIS HC A03/MF A01 CSCL 05/2

In experiments measuring latencies to answer questions about relative locations, Lea (1975) supported a hypothesis that locations are represented in a list ordered according to adjacency relations, and Hintzman, O'Dell, and Arndt (1979) supported a hypothesis that distances and directions between objects are represented. We propose a hypothesis that locations are represented using a spatial schema and that procedures for answering questions include processes that operate on positions in the spatial schema. We hypothesize further that different performance observed by Hintzman et al and Lea can be interpreted as a difference of retrieval procedures induced by differences in the ways that questions were presented. We conducted an experiment in which different questions were asked in different conditions about locations of objects, where the tasks were comparable in ways that Hintzman et al's task and Lea's task were not. Latencies in the two conditions differed in the same way as the earlier findings, lending support to the hypothesis of different retrieval procedures induced by differences in the question answering tasks. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-19968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NASA/BALTIMORE APPLICATIONS PROJECT: AN EXPERIMENT IN TECHNOLOGY TRANSFER
Thomas S. Golden Mar. 1981 29 p refs Presented at Ann. Meeting for the Advancement of Sci., San Francisco, Jan. 1980
(NASA-TM-82110) Avail: NTIS HC A03/MF A01 CSCL 05A

Conclusions drawn from the experiment thus far are presented. The problems of a large city most often do not require highly sophisticated solutions: the simpler the solution, the better. A problem focused approach is a greater help to the city than a product focused approach. Most problem situations involve several individuals or organized groups within the city. Mutual trust and good interpersonal relationships between the technologist and the administrator is as important for solving problems as technological know-how. E.D.K.

N81-19969# Air Force Academy, Colo. Dept. of Physics.
THE USAF ACADEMY FLYWHEEL-ELECTRIC CAR Final Technical Report, 31 May 1979 - 31 Dec. 1980
Robert G. Schwein, Jr. Dec. 1980 36 p
(AF Proj. 2303)
(AD-A095130; FJSRL-TR-80-0025; FTR-2) Avail: NTIS HC A03/MF A01 CSCL 13/6

This is the second and final report on the USAF Academy Flywheel-Electric Car. The car is an operational test vehicle, not a prototype for a commercial car. It weights 3100 pounds, carries 4 passengers, and cruises at 40 miles per hour for about 100 miles before recharging. Technical details are presented that will provide guidance to the reader who wishes to construct a similar vehicle. GRA

N81-19970# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRIC VEHICLE SIMULATION FOR DESIGN OPTIMIZATION M.S. Thesis
Kenneth A. Stafford Dec. 1980 118 p refs
(AD-A094734; AFIT/GAE/AA/80D-19) Avail: NTIS HC A06/MF A01 CSCL 13/6

Currently available electric passenger vehicles have revealed a lack of design sophistication that has highlighted the need for an accurate method of forecasting performance. An electric vehicle computer simulation program was developed to satisfy that need. The approach was to establish a very comprehensive and flexible vehicle model and simulate its operation on a realisitc driving cycle. The driving cycle selected was the Federal Urban Driving Sequence. A thorough vehicle model was established that incorporates aerodynamic drag, rolling resistance, both rotational and translational inertial effects, and component by component dynamic power train efficiencies. Battery discharge performance is tracked by a fractional-utilization algorithm with corrections for short-term discharge effects. The simulation compares required power obtained from the driving cycle speed schedule and vehicle model characteristics with the available power at the motor for each time increment of the driving cycle to compute battery fraction used and deviation from the speed schedule when available power is insufficient. These results of the simulation can be used to evaluate an existing vehicle's performance, or, if desired, to develop vehicle parameters to obtain a specified performance level. GRA

N81-19971# Escher Technology Associates, St. Johns, Mich.
LIQUID-HYDROGEN AUTOMOTIVE ONBOARD STORAGE AND SERVICING SYSTEM PROJECT Progress Report
Walter Finley Stewart and William Julius Daniel Escher 1981 8 p Presented at the Soc. of Automotive Engr. Intern. Eng.

Congr. and Exposition, Detroit, 23-27 Feb. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3491; CONF-810206-4) Avail: NTIS HC A02/MF A01

An intermediate sized automobile adapted to liquid hydrogen fuel was road tested. A semiautomatic fueling station is used to service (refuel) the experimental vehicle. A 150-l (39.6-gal.) cryogenic liquid hydrogen storage tank mounted in the trunk compartment and the dashboard fuel gauging system are described. The V-6 turbocharged engine was converted to hydrogen operation. DOE

N81-19972# Sheffield Univ. (England). Dept. of Control Engineering.
AN OPTIMAL CONTROL APPROACH TO ENERGY MINIMIZATION IN ELECTRIC VEHICLES
J. B. Edwards and K. Pacey (Chloride Legg Ltd.) Apr. 1980 23 p refs Presented at Inst. of Mech. Engr. Conf. on System Eng. in Land Transport, Sussex, England, 24-25 Sep. 1980
(Rept-109) Avail: NTIS HC A02/MF A01

An optimal control strategy designed to minimize the energy losses incurred by an electric vehicle in making a journey of prespecified time and distance was analyzed. A boundary value iteration method was successfully applied to a series-motordriven vehicle on undulating gradient profiles. A significant influence of drive characteristics on the optimal driving strategy was found. The need for continuing investigation into the optimal control of a wide range of drives is emphasized. Author (ESA)

N81-19973# Brookings Institution, Washington, D. C.
THE IMPACT OF FEDERAL GRANTS ON THE CITY OF CHICAGO: A CASE STUDY FOR BROOKINGS INSTITUTION. FEDERAL AID CASE STUDIES SERIES PAPER NO. 6 Final Report
Charles J. Orlebeke Apr. 1980 133 p refs Prepared in cooperation with Illinois Univ. at Chicago Circle Sponsored in part by the Dept. of Commerce, Washington, D.C.
(Grant DOL-23-11-77-03)
(PB81-121139; MEL-80-11) Avail: NTIS HC A07/MF A01 CSCL 13B

This is one of a series of studies of how particular large cities have used federal aid, with emphasis on the 1977 to 78 economic stimulus expansion of the federal grants for public service employment, local public works, and antirecession fiscal assistance. The studies use a common analytic framework to enable comparison across cities with differing economic, budgetary, and political circumstances. Each of the studies traces growth and uses of federal aid in the 1970's and seeks to respond to four types of questions: (1) to what extent have cities become dependent on federal grants to pay for basic services; (2) has the Carter Administration's Economic Stimulus Program of 1977 to 78 helped reduce unemployment; (3) who benefits from the federally supported programs; and (4) who at the local level decides how the federal aid money is spent. GRA

N81-19974# Brookings Institution, Washington, D. C.
CASE STUDIES OF THE IMPACT OF FEDERAL AID ON MAJOR CITIES, CITY OF BOSTON. THE IMPACT OF FEDERAL GRANTS ON BOSTON IN 1978. FEDERAL AID CASE STUDIES SERIES PAPER NO. 7 Final Report
Jonathan D. Katz (Brandeis Univ.) Oct. 1980 96 p refs Sponsored in part by Dept. of Commerce
(Grant DOL-23-11-77-03)
(PB81-121121; MEL-80-15) Avail: NTIS HC A05/MF A01 CSCL 13B

Federal aid to Boston in fiscal 1978 had several important effects on the city government's fiscal position and its work force, on public and private investment in the city's economy. Among the most important and most immediate effects were those of the economic stimulus package, which combined direct fiscal aid, public service jobs, and public works. These programs gave Boston a psychological and financial boost. They helped the city stabilize an extremely high property tax rate while maintaining, and in some cases expanding, city services. GRA

N81-19975# Vought Corp., Dallas, Tex.
PASSIVE VEHICLE-AUTOMATED GUIDEWAY TRANSIT. DOCUMENTATION OF PREVIOUS WORK AND ASSESSMENT OF IMPACT OF NEW TECHNOLOGY ON THIS CONCEPT Final Report
A. R. Larson, Jr., R. S. Jacobsen, V. W. Hall, and D. G. Randolph, Jr. Aug. 1980 133 p refs
(PB81-117079; UMTA-TX-06-0030-80-1) Avail: NTIS HC A07/MF A01 CSCL 13F

The development of the passive vehicles (PV) automated guideway transit (AGT) system is documented and its potential as a concept that could provide technology to improve AGT system operational costs is assessed. The documentation includes a full description of the system, the application and cost studies performed, details of the control system, the 1/5 scale operational model, the results of the full scale LIM motor thrust verification tests, full scale engineering prototype system and test results. A cost/benefit analysis relative to conventional AGT systems is presented. Application study results are given which show the effect of vehicle size on costs, service, and performance. The technical and economic feasibility of modular construction of the Active Guideway System is also explored. The critical technology required for full development and deployment of passive vehicle systems is identified and a plan for implementation of this development is presented. GRA

N81-19976# Office of Science and Technology, Washington, D. C.
CONSOLIDATION OF FEDERAL SCIENTIFIC AND TECHNOLOGICAL ACTIVITIES
May 1980 104 p refs
(PB81-132250) Avail: NTIS HC A06/MF A01 CSCL 05A

Six of the principal alternatives for major consolidation of Federal scientific and technical activities are set forth, as well as some of the variations. A discussion of the arguments for and against consolidation with respect to six of the functions that need to be effectively performed in support of federal scientific and technological activites is presented. E.D.K.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-19977 Colorado Univ. at Boulder.
SPECTROSCOPIC STUDIES OF WOLF-RAYET STARS WITH ABSORPTION LINES Ph.D. Thesis
Philip Louis Massey 1980 206 p
Avail: Univ. Microfilms Order No. 8103119

A radial velocity study of nine Wolfe-Rayet (WR) stars known or suspected to be binaries was undertaken in order to determine masses and ascertain duplicity. The combination of high dispersion coude spectroscopy and improved measuring and reduction procedures proved very fruitful for determining velocities. New double-lined orbit solutions are presented for CV Ser, HD 186943, GP Cep and CX Cep. Knowledge of these masses, plus those in the literature, reveals that the masses of WR stars range from approx. 10 solar mass to approx. 40 solar mass. Although 10 solar mass is the traditional value for the mass of a WR star, most of the known masses are significantly greater than this. Although the mass ratios of WR binaries are clearly different that those of their progenator O-type systems, their periods are not significantly different, which indicates that neither the conservative nor simplistic nonconservative calculations can adequately explain the observations. From the masses and spectrophotometry, it was argued that WR stars of identical subtype can be quite different in physical properties. Dissert. Abstr.

N81-19978# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
STRUCTURE OF NEW TWILIGHT EMISSIONS NEAR 6200 AND 7000 A
V. I. Krasovskii and A. I. Semenov 1981 4 p Transl. into ENGLISH from Astron. Tsirkulyar (USSR), no. 1124, 1980 p 1-3
(NRC/CNR-TT-1997; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

Fluorescent emissions of H2O+ observed in Kohoutek Comet near 7000 angstroms are described. Data, in table form, include: 1) mean values of lines obtained near 6200 and 7000 A; 2) wavelengths of bands of H2O+ present in Kohutek; 3) theoretically calculated values for H2O+; 4) known quanta of the Swan C2 bands; and 5) emissions of atmospheric hydroxyl. S.F.

N81-19979*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CCD PHOTOMETRY OF 1218+304, 1219+28 AND 1727+50: POINT SOURCES, ASSOCIATED NEBULOSITY AND BROADBAND SPECTRA
Donna Weistrop, David B. Shaffer (NRAO/Phoenix Corp.), Richard F. Mushotzky, Harold J. Reitsma (Arizona Univ.), and Bradford A. Smith (Arizona Univ.) Feb. 1981 37 p refs Submitted for publication
(NASA-TM-82090) Avail: NTIS HC A03/MF A01 CSCL 03A

Visual and far red surface photometry were obtained of two X-ray emitting BL Lacertae objects, 1218+304 (2A1219+305) and 1727+50 (Izw 187), as well as the highly variable object 1219+28 (ON 231, W Com). The intensity distribution for 1727+50 can be modeled using a central point source plus a de Vaucouleurs intensity law for an underlying galaxy. The broad band spectral energy distribution so derived is consistent with what is expected for an elliptical galaxy. The spectral index of the point source is alpha = 0.97. Additional VLBI and X-ray data are also reported for 1727+50. There is nebulosity associated with the recently discovered object 1218+304. No nebulosity is found associated with 1219+28. A comparison of the results with observations at X-ray and radio frequencies suggests that all the emission from 1727+50 and 1218+304 can be interpreted as due solely to direct synchrotron emission. If this is the case, the data further imply the existence of relativistic motion effects and continuous particle injection. E.D.K.

N81-19980# Computer Sciences Corp., El Segundo, Calif.
ULTRAVIOLET SPECTROPHOTOMETRY OF CLOSE BINARY SYSTEMS: CV VELORUM, RS VULPECULAE AND DH CEPHEI
Chi-Chao Wu and Joel A. Eaton (Vanderbilt Univ.) 1981 12 p refs
Avail: NTIS HC A02/MF A01

The ultraviolet magnitudes of CV Velorum, RS Vulpeculae and DH Cephei are reported. Aside from twenty observations of CV Velorum which fell inside the primary eclipse, all data were obtained for phases outside eclipse. Observations were made with the University of Greningen experiment on board the Astronomical Netherlands Satellite. The instrument consists of a 22 cm aperture Cassegrain telescope followed by a five channel grating spectrophotometer. Instrument operation modes and data correction procedures are briefly described. M.G.

N81-19981# Los Alamos Scientific Lab., N. Mex.
LINEAR AND NONLINEAR PULSATION OF (BETA) CEPHEI STARS
A. N. Cox and S. W. Hodson 1980 6 p refs Presented at the Intern. Astron. Union Colloq. 58 on Stellar Hydrodyn., Los Alamos, N. Mex., Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2818) Avail: NTIS HC A02/MF A01

Data from the (BETA) Cephei variable (ALPHA) Virginis was analyzed. It was used to see if the pulsations can be caused by mixing of hydrogen and helium in the semiconvective zone. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-19982 Utah Univ., Salt Lake City.
TOPICS IN RELATIVISTIC ASTROPHYSICS Ph.D. Thesis
Robert John Bontz 1980 147 p
Avail: Univ. Microfilms Order No. 8103664

Four topics in relativistic astrophysics are presented. These are (1) a low frequency analysis of the spectrum of gravitational radiation generated by astrophysical sources, (2) a study of the observational signature of a massive galactic halo using the gravitational lens effect, (3) the focussing of gravitational radiation by the gravitational field of the Sun, and (4) the relation of observed deviations in the cosmic background radiation spectrum to physical processes operating in the early Universe. Dissert. Abstr.

N81-19983 Arizona Univ., Tucson.
THE CHROMOSPHERES OF M DWARF STARS Ph.D. Thesis
Mark Steven Giampapa 1980 205 p
Avail.: Univ. Microfilms Order No. 8105311

Single-component, homogeneous, quiescent semi-empirical model chromospheres are constructed, based upon high resolution, well-calibrated profiles of the Ca II K line in 3 dMe and 2 dM stars. The results of the atmospheric models inferred from the observed Ca II K line profiles reveal several systematic trends which characterize the chromospheres of M dwarf stars. In particular, high values of T min/Teff are deduced for the stars considered, thus indicating an unusually large degree of nonradiative heating present in the upper photospheres of M dwarf stars. Hence dissipation of mechanical energy is an important parameter in the control of the energy balance in the upper photospheres of M dwarf stars. The value of the lower chromospheric temperature gradient, dT/d log m, is similar for the M dwarf stars considered. Chromospheric K-line emission strength is most sensitive to the total amount of chromospheric material present within the approximate temperature range Tmin-6000K. Dissert. Abstr.

N81-19984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESONANT ELECTRODYNAMIC HEATING OF STELLAR CORONAL LOOPS: AN LRC CIRCUIT ANALOGUE
James A. Ionson Dec. 1980 50 p refs Submitted for publication
(NASA-TM-82065) Avail: NTIS HC A03/MF A01 CSCL 03B

The electrodynamic coupling of stellar coronal loops to underlying beta < velocity fields. A rigorous analysis revealed that the physics can be represented by a simple yet equivalent LRC circuit analogue. This analogue points to the existence of global structure oscillations which resonantly excite internal field line oscillations at a spatial resonance within the coronal loop. Although the width of this spatial resonance, as well as the induced currents and coronal velocity field, explicitly depend upon viscosity and resistivity, the resonant form of the generalized electrodynamic heating function is virtually independent of irreversibilities. This is a classic feature of high quality resonators that are externally driven by a broad band source of spectral power. Applications to solar coronal loops result in remarkable agreement with observations. Author

N81-19985# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THREE DIMENSIONAL ORBITAL STABILITY ABOUT THE EARTH-MOON EQUILATERAL LIBRATION POINTS M.S. Thesis
Howard A. Tilton Dec. 1980 108 p refs
(AD-A094773; AFIT/GA/AA/80D-4) Avail: NTIS HC A06/MF A01 CSCL 22/3

A search for a stable three dimensional orbit for a satellite about L4 is performed. A proposed two dimensional very restricted orbit is used to supply the initial conditions required for the search. An ephemeris of high accuracy is generated from a

specific date and time using actual positions for the Sun and Moon. The generated Sun and Moon position and velocity vectors are used in the integration of the system's equations of motion. A stable orbit is found and is tested for its length of stability. The orbit is found to have a stable lifetime in excess of six hundred lunar synodic months. The sensitivity of the orbit to the Sun's and Moon's position is tested and found to be only slightly sensitive for an error in position of one quarter day. Finally, a predicted 180 deg out of phase orbit is found and is determined to be only marginally stable. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-19986*# Arizona Univ., Tucson.
ATOMIC CLOUDS AS DISTRIBUTED SOURCES FOR THE PLASMA TORUS
R. A. Brown and W.-H. Ip (Max-Planck-Inst. fuer Aeronomie, Katlenburg, Lindau, West Germany) Mar. 1981 15 p refs
(Grant NsG-7634)
(NASA-CR-163997) Avail: NTIS HC A02/MF A01 CSCL 03C

Implications of recent developments for the neutral particle environment of Jupiter are considered. The first detection is reported of very hot S+ ions with gyrospeeds comparable to the corotations speed, a phenomenon which results from a neutral sulfur cloud. Evidence supports the hypothesis that extensive neutral clouds of oxygen and sulfur exist and are important sources of ions and energy for the Io torus. Author

N81-19987*# Harvard Univ., Cambridge, Mass.
THE ROTATION OF URANUS
Richard M. Goody 1981 11 p refs
(Grant NGL-22-007-228)
(NASA-CR-163987) Avail: NTIS HC A02/MF A01 CSCL 03C

A historical review of the use of three independent techniques for measuring the rotational rate is presented. The approaches examined are: (1) using theoretical interior models together with observations of the oblateness and the gravitational moment; (2) studying periodic fluctuations in the brightness; and (3) spectrographically measuring the Doppler shifts (line tilts). Measurements of line tilts obtained using the Kitt Peak National Observation 4 meter telescope with a Cassegrain echelle to high obtain high spectral dispersion and large image are discussed and compared with results obtained by Muench and Hipplelein (1980) and by Hayes and Belton (1977). The possibility of using speckel imaging techniques to detect the motion of features across the disc in the 6091 methane band, and with more suitable image intensifiers, in the 7261 band is considered. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-19988*# Stanford Univ., Calif. Inst. for Plasma Research.
IMPULSIVE PHASE OF SOLAR FLARES. 1: CHARACTERISTICS OF HIGH ENERGY ELECTRONS
John Leach and Vahe Petrosian Mar. 1981 49 p refs
(Grant NsG-7092)
(NASA-CR-164031) Avail: NTIS HC A03/MF A01 CSCL 03B

The variation along a magnetic field line of the energy and pitch angle distribution of high energy electrons injected into a cold hydrogen plasma containing either an open or closed magnetic field structure was investigated. The problem is formulated as a time independent Fokker-Planck Equation for the electron number distribution as a function of the electron energy, electron pitch angle, and the structure of the global magnetic field. Simple analytic solution valid in the small pitch angle regime and for slowly varying magnetic field is presented. For the more general situation a numerical code for solving the Fokker-Planck Equation was used and it was found that the analytic expression agrees well with the numerical results to values of the pitch angle much larger than expected. For most practical applications, one many confidently use the analytic expression instead of having to resort to lengthy numerical computations. These results are useful in the study of the nonthermal models of the impulsive phase of solar flares. E.A.K.

N81-19989*# Stanford Univ., Calif. Inst. for Plasma Research.
DISCREPANCIES BETWEEN EMPIRICAL AND THEORETICAL MODELS OF THE FLARING SOLAR CHROMOSPHERE AND THEIR POSSIBLE RESOLUTION
Gordon A. Emslie, John C. Brown (Glasgow Univ.), and Marcos E. Machado (CNIE, Buenos Aires) Aug. 1980 27 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-164041; SU-SUIPR-820) Avail: NTIS HC A03/MF A01 CSCL 03B

Models of the solar chromosphere during flaring deduced theoretically or empirically are compared. Marked discrepancies are noted and various reasons are offered to explain their existence. A means is presented for testing theoretical heating models (electron heating) by analyzing the net energy loss rates in (observed) empirical atmospheres and inverting the flare energy equation to deduce the parameters of the supposed heating mechanism. A.R.H.

N81-19990*# Stanford Univ., Calif. Inst. for Plasma Research.
A COMPARISON OF THE HEIGHT DISTRIBUTIONS OF SOLAR FLARE HARD X-RAYS IN THICK TARGET AND THERMAL MODELS
A. Gordon Emslie Oct. 1980 32 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-164040; SU-SUIPR-822) Avail: NTIS HC A03/MF A01 CSCL 03B

The height structure of hard X-ray bremsstrahlung emission in solar flares is computed for two different models of bremsstrahlung production: emission from a descending beam of nonthermal electrons, and thermal emission from a coronally confined hot plasma. It is shown how these models give rise to hard X-ray spatial distributions which are distinguishable by current instrumentation, and that, therefore, the models may be distinguished by such spatially resolved hard X-ray measurements. A.R.H.

N81-19991# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
HIGH RESOLUTION X-RAY SPECTROSCOPY AND SOLAR HELIOGRAPHY FROM ROCKETS [HOCHAUFLOESENDE ROENTGENSPEKTROSKOPIE UND HELIOGRAPHIE DER SONNE MIT RAKETEN]
Hans R. Haerle Mar. 1980 156 p refs In GERMAN
(Contract BMFT-RV-14-B204/73)
(MPI-PAE/Extraterr-162; ISSN-0340-8922) Avail: NTIS HC A08/MF A01

Data obtained for line emissions of high ion atom activity areas in the disturbed Corona, with the same origins, the diminishing physical processes and the correlation processes for certain condition parameters were compared with models from interference areas. Three different camera techniques were employed. Theoretical spectra of a hot plasma, produced by the Corona were computed based on results from initial experiments. It was found that the small band X-ray photography method is better for detailed investigation of coronal structures than the X-ray spectroscopy method. Transl. by E.A.K.

N81-19992# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
SOLAR ECLIPSE (1979). PART 2: INITIAL RESULTS FOR

IONIZATION SOURCES, ELECTRON DENSITY, AND MINOR NEUTRAL CONSTITUENTS Final Report
Melvin G. Heaps, Robert O. Olsen, K. D. Baker, D. A. Burt, and L. C. Howlett Oct. 1980 71 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A094809; ERADCOM/ASL-TR-0069) Avail: NTIS HC A04/MF A01 CSCL 03/3

The 26 February 1979 solar eclipse provided a unique opportunity to investigate the properties of the middle atmosphere and lower ionosphere. This event served as the focal point of a cooperative field measurements program involving the US Army Atmospheric Sciences Laboratory, the Air Force Geophysics Laboratory, the National Aeronautics and Space Administration (Wallops Flight Center), and the National Research Council of Canada. This report surveys the initial data and findings of the two Army sponsored Nike-Orion rockets launched during the eclipse period. Measurements were provided of electron density, ionization sources, and critical minor constituents. The electron density profile showed a rather broad peak near 100 km with a maximum density of about 200,000 per cc. Measurements of ionization sources confirm the fact that during the eclipse period a particle precipitation event was in progress that largely dominated the ionization in the D and E regions. GRA

N81-19993*# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
DECELERATION OF THE SOLAR WIND IN THE EARTH FORESHOCK REGION: ISEE 2 AND IMP 8 OBSERVATIONS
C. Bonifazi, G. Moreno, A. J. Lazarus (MIT, Cambridge, Mass.), and J. D. Sullivan (MIT, Cambridge, Mass.) Jan. 1980 28 p refs Submitted for publication Sponsored in cooperation with CNR
(Contract NAS5-11062)
(NASA-CR-164000; LPS-80-1) Avail: NTIS HC A03/MF A01 CSCL 03B

The deceleration of the solar wind in the region of the interplanetary space filled by ions backstreaming from the Earth bow shock was studied using a two spacecraft technique. This deceleration, which is correlated with the 'diffuse' but not with the 'reflected' ion population, depends on the solar wind bulk velocity: at low velocities (below 300 km/sec) the velocity decrease is about 5 km/sec, while at higher velocities (above 400 km/sec) the decrease may be as large as 30 km/sec. Along with this deceleration, the solar wind undergoes a deflection of about 1 deg away from the direction of the Earth bow shock. The energy balance shows that the kinetic energy loss far exceeds the thermal energy which is possibly gained by the solar wind, therefore, at least part of this energy must go into waves and/or into the backstreaming ions. Author (ESA)

N81-19994*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE POLARIZATION STATE OF HYDROMAGNETIC FLUCTUATIONS IN THE SOLAR WIND
B. Bavassano, M. Dobrowolny, F. Mariani, and N. F. Ness Apr. 1980 25 p refs Prepared in cooperation with Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio
(NASA-TM-82282; LPS-80-9) Avail: NTIS HC A02/MF A01 CSCL 03B

From presently available observations it can be inferred that the Alfvenic turbulence measured in the solar wind, predominantly on trailing edges of high speed streams, is a mixture of modes with two different polarizations, namely, Alfvenic modes and modes which are the incompressible limit of slow magnetosonic waves. Using Helios 2 magnetic data and a variance analysis, parallel (to the mean field) and perpendicular components of the fluctuations are separated and the possible correlation between such components is studied. Correlations between eigenvalues of the variance matrix are also investigated and discussed.
Author (ESA)

N81-19995# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 432, AUGUST 1980. PART 2 (COMPREHENSIVE REPORTS). DATA FOR FEBRUARY 1980 AND MISCELLANEA
Helen E. Coffey Aug. 1980 52 p refs
(PB81-124950; NOAA-80100806) Avail: NTIS HC A04/MF A01 CSCL 03B

In addition to an index for 1979-1980, data are provided for February 1980 on: solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. Miscellaneous data consist of: energetic solar particles and plasma for January 1980 and 3 Nov. - 27 Dec. 1979, and synoptic solar maps 3 Nov. - 27 Dec. 1979. GRA

N81-19996# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 432, AUGUST 1980. PART 1: (PROMPT REPORTS). DATA FOR JUNE, JULY 1980 AND LATE DATA
Helen E. Coffey, ed. Aug. 1980 173 p refs
(PB81-124968; SGC-432-Pt-1; NOAA-80100805) Avail: NTIS HC A08/MF A01 CSCL 03B

In addition to an index for 1979-1980, data are presented for July 1980 on: alert periods, daily solar indices, solar flares, solar radio emission, solar wind measurements, coronal holes, spacecraft observations, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. Also data are given for June 1980 on daily solar activity centers, sudden ionospheric disturbances, spacecraft observations, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. Late data include solar radio emission June 1980, coronal holes, and cosmic rays Deep River/Alert May 1980. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-19997 Cornell Univ., Ithaca, N. Y.
THEORY OF ELECTRON-POSITRON SHOWERS IN DOUBLE RADIO SOURCES Ph.D. Thesis
Michael Lawrence Burns 1980 141 p
Avail: Univ. Microfilms Order No. 8102977

A systematic theoretical study of the electromagnetic showers which may occur in double radio sources is presented. Coupled relativistic collisional Boltzmann equations are derived for the electrons, positrons, and gamma rays in the shower. The scattering medium for the shower is considered to be a spectrum of low energy photons originating from the inner part of the accretion disc. The scattering processes involve (1) production of an energetic electron-positron pair by the scattering of a gamma ray and a low-energy photon, and (2) the production of gamma ray by the Compton scattering of an energetic electron off of a low energy photon. The optical depth for the shower, zeta(z), is finite for z approaching infinity owing to the fact that the low energy photon density decreases as z(2). As a result of zeta (infinity) being finite the shower particles break out in the sense that they suffer no further scattering beyond a certain distance. At breakout, a spectrum of electrons, positrons, and gamma rays exists which then propagate ballistically in the + or z directions. The electrons and positrons eventually encounter a region of curved magnetic field where radio emission occurs. The important consequences of the theory of the showers are the spectra of the electrons (or positrons) and gamma rays.
Dissert. Abstr.

N81-19998*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PULSAR AND DIFFUSE CONTRIBUTIONS TO THE OBSERVED GALACTIC GAMMA RADIATION
A. K. Harding and F. W. Stecker Oct. 1980 15 p refs Submitted for publication
(NASA-TM-82028) Avail: NTIS HC A02/MF A01 CSCL 03B

With the acquisition of satellite data on the energy spectrum of galactic gamma-radiation, it is clear that such radiation has a multicomponent nature. A calculation of the pulsar gamma ray

emission spectrum is used together with a statistical analysis of recent data on 328 known pulsars to make a new determination of the pulsar contribution to galactic gamma ray emission. The contributions from diffuse interstellar cosmic ray induced production mechanisms to the total emission are then reexamined. It is concluded that pulsars may account for a significant fraction of galactic gamma ray emission. Author

N81-19999*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALACTIC X-RAY EMISSION FROM PULSARS
Alice K. Harding Jan. 1981 43 p refs Submitted for publication
(NASA-TM-82081) Avail: NTIS HC A03/MF A01 CSCL 03B

The contribution of pulsars to the gamma-ray flux from the galactic plane is examined using data from the most recent pulsar surveys. It is assumed that pulsar gamma-rays are produced by curvature radiation from relativistic particles above the polar cap and attenuated by pair production in the strong magnetic and electric fields. Assuming that all pulsars produce gamma-rays in this way, their luminosities can be predicted as a function of period and magnetic field strength. Using the distribution of pulsars in the galaxy as determined from data on 328 pulsars detected in three surveys, the local gamma-ray production spectrum, the longitude profile, and the latitude profile of pulsar gamma-ray flux are calculated. The largest sources of uncertainty in the size of the pulsar contribution are the value of the mean interstellar electron density, the turnover in the pulsar radio luminosity function, and the average pulsar magnetic field strength. A present estimate is that pulsars contribute from 15 to 20 % of the total flux of gamma-rays from the galactic plane. Author

N81-20000*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRECURSOR ACTIVE GALAXIES AND THE COSMIC X-RAY BACKGROUND
Elihu A. Boldt and Darryl Leiter Feb. 1981 15 p refs Submitted for publication
(NASA-TM-82087) Avail: NTIS HC A02/MF A01 CSCL 03B

It is argued that the cosmic X-ray background (CXB) is not dominated by sources that are usual active galaxies or quasars. A comparable number of objects, young galaxies at z approximately < 4 containing massive black holes surrounded by hot optically thin accretion disks, constitute the precursor active galaxies (PAG) postulated here for producing the thermal type spectrum required for the CXB. An evolutionary track for such PAG objects is described which would lead to the active galaxies observed as individual nonthermal sources. Unresolved emission from active galaxies at $z < 1$ could then readily account for most of the nonthermal background observed in the gamma ray band.Author

N81-20001*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 5.57 HOUR MODULATION OF THE X-RAY FLUX OF 4U1822-37: A NEW MODEL FOR CYG X-3
N. E. White, R. H. Becker (Columbia Univ., New York), E. A. Boldt, S. S. Holt, P. J. Serlemitsos, and J. H. Swank Jan. 1981 24 p refs Submitted for publication
(NASA-TM-82079) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray flux of 4U1822-37 is shown to be modulated with the 5.57 hour period of its optical counterpart. The X-ray light curve is two component with a smooth sinusoidal like 25 percent semiamplitude modulation and a 30 minute dip approximately 0.2 in phase following the other minimum. The X-ray spectrum is a relatively flat power law up to 17 keV, above which its steepens. Iron emission is detected at 6.7 keV with a 4 keV FWHM and an equivalent width of 1100 eV. There is an excee below 2 keV that is consistent with either a 0.25 keV thermal component or 350 eV equivalent width iron L emission. A slight softening of the spectrum is seen during both X-ray minima. The dip is interpreted as the partial occultation of an extended cloud of optically thick highly ionized material surrounding the central X-ray source. Modeling the eclipse gives a system inclination of 70-79 deg and a spherical cloud radius of 0.2-0.3 solar radius. Models for the long term modulation are considered. The properties of this source are compared to those of Cyg X-3. It is concluded that they are similar systems. A.R.H.

N81-20002*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION OF A GAMMA-RAY TELESCOPE USING TAGGED POSITION ANNIHILATION PHOTONS
D. L. Bertsch and W. R. Dodge (NBS, Washington, D.C.) Feb. 1981 25 p refs Submitted for publication
(NASA-TM-82103) Avail: NTIS HC A02/MF A01 CSCL 03B

Measurements of detection efficiency, angular resolution, and energy resolution properties of a gamma ray telescope used to study celestial gamma rays from balloon flight altitudes are described. Nearly monochromatic photons produced at the National Bureau of Standards tagged photon facility were used for the calibration. Details of the photon beam configuration and properties and results of the measurements made at photon energies of 15.1 and 31.1 MeV are presented. Finally, the data are compared with a Monte Carlo analysis of the instrument properties. Author

N81-20003*# California Inst. of Tech., Pasadena.
A BALLOON MEASUREMENT OF THE ISOTOPIC COMPOSITION OF GALACTIC COSMIC RAY BORON, CARBON AND NITROGEN Ph.D. Thesis
James Frederick Zumberge 1981 129 p refs
(Grant NGR-05-002-160)
(NASA-CR-164013; SRL-81-5) Avail: NTIS HC A07/MF A01 CSCL 03B

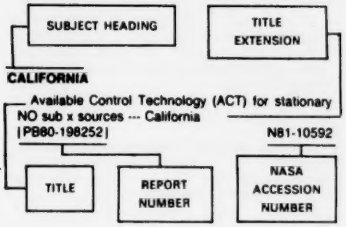
The isotopic compositions of galactic cosmic ray boron, carbon, and nitrogen were measured at energies near 300 MeV amu, using a balloon-borne instrument at an atmospheric depth of approximately 5 g/sq cm. The calibrations of the detectors comprising the instrument are described. The saturation properties of the cesium iodide scintillators used for measurement of particle energy are studied in the context of analyzing the data for mass. The achieved rms mass resolution varies from approximately 0.3 amu at boron to approximately 0.5 amu at nitrogen, consistent with a theoretical analysis of the contributing factors. Corrected for detector interactions and the effects of the residual atmosphere the results are B-10/B = 0.33 (+0.17, -0.11), C-13/C = 0.06 (+0.13, -0.11), and N-15/N = 0.42 (+0.19, -0.17). A model of galactic propagation and solar modulation is described. Assuming a cosmic ray source composition of solar-like isotopic abundances, the model predicts abundances near Earth consistent with the measurements. Author

99 GENERAL

N81-20004# Technical Research Centre of Finland, Espoo.
[APPLIED RESEARCH ACTIVITIES FOR 1979] Annual Report
1980 26 p Original contains color illustrations
Avail: NTIS HC A03/MF A01

Work in building construction; city planning; materials development and processing; energy technology; and information technologies is reviewed. Structural stress from ice loads, building design, reactor safety, the use of peat in power plants, and the industrial use of enzymes are mentioned. Author (ESA)

Typical Subject Index Listing



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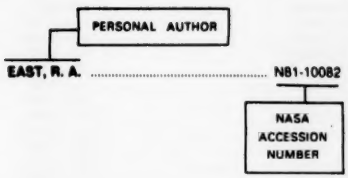

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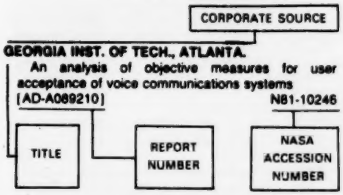

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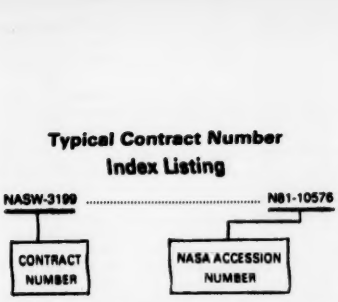

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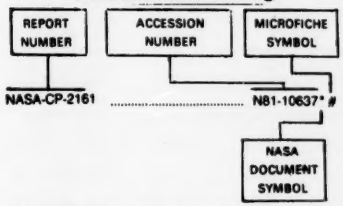

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